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MP MASTER



MA28020

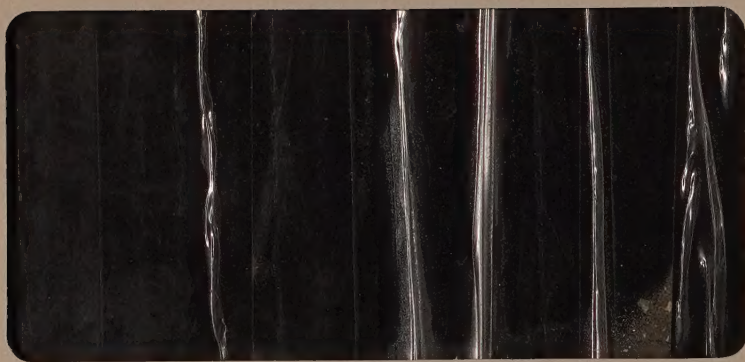
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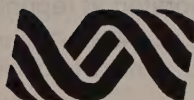
IEC User's Guide

for the

4801iL

Harmonic/Flicker Test Systems

CI P/N 5001-970



**California
Instruments**

Printed in USA May 1996

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HFTS Software License

Your 4801iL IEC Test System was shipped with one copy of the HFTS software. This software - model number CIC440 - is owned by California Instruments and is protected by United States copyright laws and international treaty provisions. Therefore, you must treat the software like any other copyrighted material.

Software Revisions

Revision codes on the HFTS software opening screen and Help, About screen indicate the current revision. Minor changes to the software such as bug fixes usually do not require a change to the manual. Therefore, the revision number of the software you received with the 4801iL may be higher than the software revision number shown below. In this case, the information in the manual still applies.

Software changes that require a manual change will be accompanied either by a new edition of the manual or an errata sheet documenting the changes.

This manual applies to software revisions A.00.00 through A.00.02

Printing History

The manual printing date indicates the current edition. The printing date changes with each new edition or update. Update packets or change sheets may be issued between editions to correct or add information. Minor corrections incorporated at reprint do not cause a new edition.

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Introduction

About this Manual

This manual describes the operation of the Harmonic/Flicker Test Software when used in conjunction with a 4801iL AC power source/analyzer. This manual assumes that you are familiar with the IEC standards and their requirements. A clear understanding of the Windows 3.1 operating environment and the PC is also required to take full advantage of the HFTS software.

The Harmonic/Flicker Test Software

The Harmonic/Flicker Test Software (or HFTS), is a Windows 3.1 application that supports both IEC-1000-2 and IEC-1000-3 compliance-test requirements. Refer to appendix A for a complete list of supported standards. This program provides an intuitive graphical user-interface from which you can:

- ☐ Set up and run compliance tests. Setting up many IEC details is facilitated through the use of embedded standards expertise.
- ☐ Collect real-time test data from the Harmonic/Flicker Test System.
- ☐ Display and monitor ongoing test results.
- ☐ Save test results.
- ☐ Terminate tests based on user-defined criteria.
- ☐ Analyze failures or marginal results using advanced test, display, and search options.
- ☐ Evaluate the long-term test results compared to pass/fail criteria.
- ☐ Print reports and graphs.

Equipment Supplied

- ☐ IEC software on two disks (P/N CIC440).
- ☐ IEC User's Guide (P/N 5001-970).

The IEC-1000-3-2 Standard

IEC-1000-3-2 and related standards regulate the magnitude of harmonic currents drawn by products from the ac line. For example, harmonic currents can be caused by high peak currents drawn by switch-mode power supplies. Power companies, particularly in Europe, have led a regulatory drive to limit harmonic current generation at the product level because odd order harmonics add together in the neutral conductors of three-phase distribution networks. This can cause severe overheating of neutral conductors that are dimensioned for only sinusoidal current waveforms. Personal computers and peripherals are typical examples of the types of products addressed by the standard.

IEC-1000-3-2 actually covers two classes of harmonic currents: quasi-stationary harmonics and fluctuating harmonics. Power supply manufacturers for example may be concerned primarily with the first class while product manufacturers may be concerned with both classes. For each class, different measurement techniques are used for determining compliance, with more stringent testing requirements applied to the fluctuating harmonic class. Consequently, compliance testing for fluctuating harmonics requires non-stop harmonic analysis over extended periods of time.

IEC 1000-3-2 Implementation

The HFTS software tests for compliance to the IEC-1000-3-2 standards in the following way:

- It initializes and programs the 4801iL IEC Test System.
- During the pre-test run, the software displays 1 cycle of voltage and current with Class D envelope information superimposed over the waveshapes. Rms voltage, frequency, rms current, peak current, real power, apparent power, power factor, voltage distortion, current distortion, and percent in envelope are displayed as well. An additional display of voltage distortion either "IN SPEC" or "OUT OF SPEC" indicates compliance with IEC requirements. This readout is based on the worst-case results obtained during the pretest.
- During the actual compliance test, the software produces a bar graph that represents either the absolute magnitudes of 40 harmonics, or the magnitudes of 40 harmonics compared to predetermined test limits. The graph display shows both the maximum measured value (the top part of the bar), and the value of the present data record (the lower part of the bar). The value of the present data record is continually updated while the test is running.
- The software also produces a table that displays either the absolute magnitudes of 40 harmonics, or the magnitudes of 40 harmonics compared to predetermined test limits. The table shows both the peak data values and the present data values. Note that you can also display the data of any **individual** harmonic versus time, either shown as an absolute magnitude or as a percentage of the allowable limits.

- When testing fluctuating harmonics, the software uses a 2.5 minute sliding window. Within this window harmonic peaks of up to 150% of the steady-state harmonic limits are allowed, provided that these samples do not total more than 10% of the total samples (or 15 seconds of time) within any individual 2.5 minute observation period. Samples that contribute to a 2.5 minute window failure must fall between 100% and up to 150% of the steady-state harmonic limits. Values greater than 150% of the limits are counted as individual failures.

The IEC-1000-3-3 Standard

IEC-1000-3-3 regulates the magnitude, rate, and time-duration of **voltage fluctuations** or **flicker** caused by products connected to the ac line. Voltage fluctuations that cause flicker are created by time-varying current drains across the branch circuit impedance that exist in all power distribution networks.

Because flicker is annoying, and can present a health hazard for certain individuals, the standard aims to regulate flicker generation to an imperceptible level. A dedicated instrument called a flickermeter, which is built into the 4801iL IEC Test System, is used to measure voltage fluctuations in terms of human perceptibility. A perceptibility level of 1 reflects the threshold of perception for the average individual.

IEC 1000-3-3 Implementation

The HFTS software tests for compliance to the IEC-1000-3-3 standards in the following way:

- ❑ It initializes and programs the 4801iL IEC Test System.
- ❑ During the pre-test, the software shows one cycle of voltage and current with Class D envelope information superimposed over the waveshapes. Rms voltage, frequency, rms current, peak current, real power, apparent power, power factor, voltage distortion, and current distortion are also shown.
- ❑ During the actual compliance test, the software produces a graph which displays the short-term flicker (**Pst**) compared to the predetermined test limits. The graph shows both the maximum measured value (the top part of the bar), and the present value (the lower part of the bar).
- ❑ Probability and distribution graphs reflect a statistical view of the raw data used to generate the **Pst** graph. Note that long term flicker or Plt data is only generated during post processing after the test has completed . This information is included in the long form report.
- ❑ The software also generates a graph which displays the selected time range of rms voltage values. This graph effectively shows a time-series of rms voltage variations produced by the varying load currents flowing through a reference impedance.
- ❑ Summary values for maximum rms voltage deviation (**Dmax**), steady-state voltage change (**Dc**), and the time interval during which the voltage deviation exceeds the prescribed limit (**Dt**), are displayed at the bottom of each IEC-1000-3-3 display. These are the maximum values for each parameter within the presently displayed integration period.
- ❑ Finally, the software also displays the time-series for instantaneous flicker, which can be useful for diagnosing faults in the equipment under test.

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Software Installation

Running the Install program

Note	Before proceeding with the installation of the HFTS software, review the readme file (README.TXT) which is included on the installation disks. This file contains any product updates or corrections that are not documented in this manual. Use any text editor to open and read this file either before or after you install the software.
-------------	--

Insert the first Setup disk in the A or B drive of your computer.

From the File Manager, type A:\INSTALL or B:\INSTALL

Follow the prompts that appear on your screen to install the software.

As part of the installation procedure, you will be asked to specify a directory in which to install the HFTS software (the default is C:\HFTS).

You will also be asked to select the default voltage and frequency settings for the equipment that you will be testing (choose either 120 Vac/ 60 Hz or 230 Vac/ 50 Hz). This option may help in avoiding the accidental application of damaging voltages to the equipment under test. These selections may be changed at any time in the Standard Test Options window.

Connecting the 4801iL Source

To use the HFTS Software you must install or connect the following equipment to your personal computer.

1. Make sure that a National GP-IB interface card (model AT-GPIB/TNT) or HP-IB interface (model HP 82335B) has been installed in your computer.
2. Install the 4801iL IEC Test System and connect it to the computer.
3. Configure the 4801iL IEC Test System for remote sensing at the input terminals of the equipment under test
4. Turn on your computer and start the HFTS software.

Configuration Verification

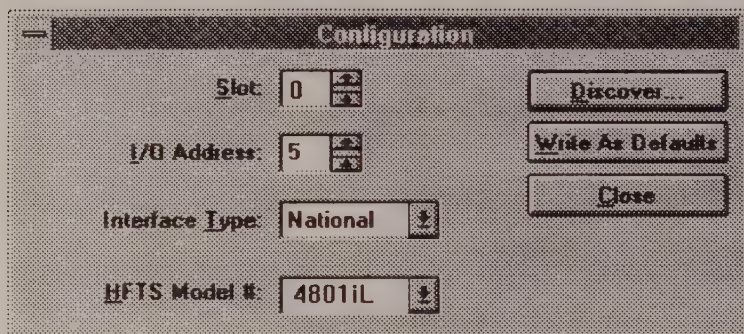
Once your equipment and software are installed, double click on the CI HFTS icon to start the software. Upon start-up, the HFTS software automatically searches for an interface card and

Installation

queries the 4801iL IEC Test System to verify the correct model number. To confirm that your configuration is correct, proceed as follows:

1. select the **New** button in the Welcome Window
2. from the **Options** menu, select the **Configure...** command

A Configuration Dialog box appears on the screen that provides the following information regarding your equipment:



The screenshot shows a 'Configuration' dialog box with the following fields and buttons:

- Slot:** 0
- I/O Address:** 5
- Interface Type:** National
- HFTS Model #:** 4801iL
- Buttons:** Discover..., Write As Defaults, Close

- ☐ The I/O interrupt slot of the interface card. Switch settings on the I/O card determine the slot address.
- ☐ The I/O address of the 4801iL IEC Test System. The instrument address can be read or set using the **Address** key on the 4801iL front panel.
- ☐ The Interface type is either National or HP-IB
- ☐ The model number of the 4801iL IEC Test System.

Pressing the **Discover** key causes the software to search for an interface card and query the 4801iL IEC Test System for its model number. Any equipment that is located is displayed in a dialog box on the screen.

Pressing **Write as Defaults** updates the HFTS.INI file with the information that has been entered in this dialog box either by the user or by the **Discover** feature.

Press **Close** to exit the dialog box.

Getting Started

There are two ways to operate the HFTS software:

1. from the drop-down menus at the top of the screen, or
2. from the menu tabs at the bottom of the screen.

Drop-down Menu

The following list briefly describes all the commands located in the drop-down menus at the top of the screen.

File Menu Commands

New...	Lets you select a new test
New From Template...	Lets you select a new test but applies an existing template
Open...	Opens an existing test
Save	Saves the presently opened test
Save As...	Saves the present test under a new name
Lock Test File	Sets the attribute of a completed test file to read only
Edit Template..	Lets you edit a template
Save As Template...	Saves only the template information of the presently opened test
Print Report...	Lets you print the currently displayed report
Print Graph/Table...	Lets you print the currently displayed graph or table
Printer Setup...	Lets you change the printer setup
Exit	Exits the application

Edit Menu Commands

Copy Table	Copies highlighted information in the presently accessed table to the clipboard
Copy Graph	Copies the presently accessed graph to the clipboard

Installation

View Menu Commands

Main	Lets you select the type of test to run
Test Setup >	Lets you select the test set-up parameters
Pre-test	Lets you run the pre-test
Test	Lets you run the test
Display >	Lets you view specific test results
Report >	Lets you view the test report

Options Menu Commands

Local Lockout	Lets you disable the front panel keys of the Harmonic/Flicker Test System
Configure...	Lets you specify the I/O slot address of the interface, the instrument address, the interface type, and the Harmonic/Flicker Test System model number.
Defaults...	Lets you view and change the default values for line voltage and frequency

Help Menu Commands

Contents	Accesses the Help contents
Using Help	Explains how to use the on-line help
About	Displays the HFTS software revision

Menu Tabs

The Menu tabs are located at the bottom of the screen and let you easily access the primary functions of the HFTS software. There are five groups of menu tabs which are briefly described here:

The **Main** level group accesses the following functions:



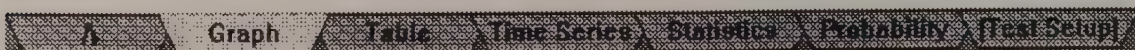
The **Pre-test** and **Test** tabs access their respective tab functions.

The > symbol indicates a sub-level of tabs, which access a number of additional screens. Once at the lower level, the  tab backs you up to the Main Level. When active, the [last tab] in the series jumps to the last lower-level tabs that you had previously accessed.

The following tabs appear in the **Test Setup>** group:



The following tabs appear in the **Display>** group for Quasi-stationary or Harmonic fluctuations:



The following tabs appear in the **Display>** group for Voltage fluctuations:



The following tabs appear in the **Report>** group:



3

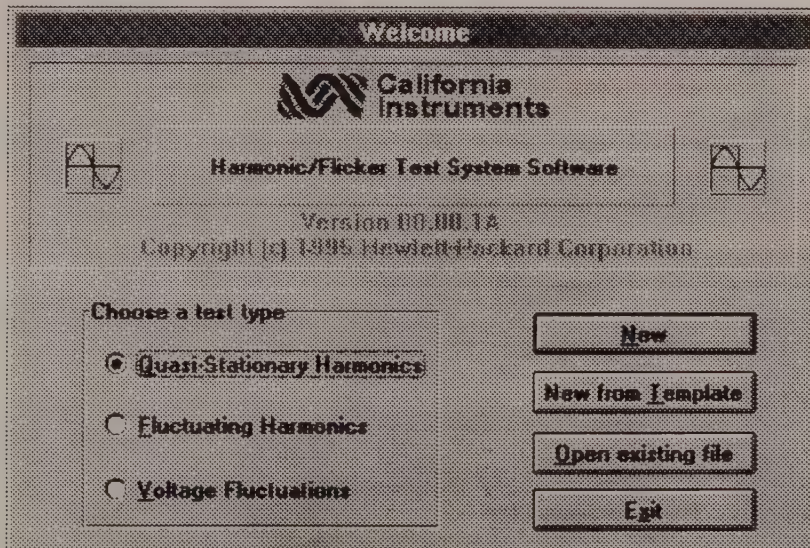
Setting Up the Test

This section requires that you have started the HFTS software. If not, double click on the CI HFTS icon to run the software. You are now ready to define your test setup.

If you have not installed the HFTS software, go back to chapter 2.

Select a Test Type

To select a test type from the Welcome Window, proceed as follows:



1. Select either Quasi-stationary Harmonics, Fluctuating Harmonics, or Voltage Fluctuations by clicking on the relevant option.
2. Choose to configure a new test, run an existing test, or configure a new test based on an existing template. Note that these selections are also available from the File menu.
 - ❑ Selecting **New** opens the Main window, in which you start entering test setup information about the test that you will be running. If you will be running other tests that require the same setup information, you can save this information in a template file once it has been entered so it can be recalled for other tests in the future.
 - ❑ Selecting **New From Template** opens a dialog box that lets you select a template file which contains previously-configured test setup information. A copy of this template information will be used to create a new data file. The template itself is not changed if you make subsequent changes to your setup. When you run the test, the test data will then be added to the information obtained from the template. You can modify the set up data as required for the new test or use the values supplied by the template you selected. The following file

Setting Up the Test

extensions are used to identify template files:

- .stt** template files for quasi-stationary harmonic tests
- .flt** template files for fluctuating harmonic tests
- .fkt** template files for voltage fluctuation tests

- Selecting Open Existing File opens a dialog box that lets you select a data file which contains setup information and may or may not contain pre-test as well as test data. This lets you examine previously run test data or replace old data with data obtained from a new test run.

The following file extensions are used to identify data files:

- .sta** data files for quasi-stationary harmonic tests
- .flu** data files for fluctuating harmonic tests
- .flk** data files for voltage fluctuation tests

Note Running a pretest or a test after opening an existing file will cause all existing data to be overwritten with new data. You can prevent this from occurring by checking the **Make test data read-only** option in the **Test** window, or by using the **Lock Test File** command in the File menu.

Creating a Template

The use of templates can save valuable time by eliminating the need to enter repetitive data. In order to create a test template, first select the **Main** window.

The screenshot shows the 'HFTS Fluctuating Harmonics test - untitled' window. The menu bar includes File, Edit, View, Options, and Help. The 'Main' window is active, displaying several input fields: 'User Name' (John Testbetter), 'Company Name' (ACME Corporation), 'Test Description' (CE Mark compliance test for fluctuating harmonics of model AXP series), 'Device Under Test ID' (AXP-5600), and 'Test ID' (SN: 10001). The bottom of the window features a tabbed interface with 'Main', 'Test Setup', 'Pre test', 'Test', 'Display', and 'Report'. The 'Test' tab is selected, showing 'IEC Class A' and 'Idle No Test' status.

1. Enter the following information into the text boxes of the **Main** window:
 your name
 the company name
 a brief description of the test procedure that you will be running
 a device ID such a model number
 a test ID such as a serial number or test number that uniquely identifies the test
2. Use the Menu Tabs on the bottom of the screen to access the Test Setup windows. Note that you can also access the Test Setup windows from the View Menu.
3. Starting with the **Standard Test Setup** window, select and configure each of the following Test Setup windows: Standard, Advanced, and Termination
4. Select **Save as Template** in the File menu to create a template file. Once created, the template file may be used to quickly create new tests by adding or editing only the information that must be changed for each test. This is useful if you are conducting a series of tests or testing similar equipment that is subject to a commonly used standardized test.

Select the Standard Test Options

Standard options are normally used for compliance testing. They are selected in the Standard window.

If you are testing Quasi-stationary or Fluctuating harmonics the following standard options are selectable:

The screenshot shows the 'HFTS Fluctuating Harmonics test - untitled' window. The menu bar includes 'File', 'Edit', 'View', 'Options', and 'Help'. The title bar indicates 'Setup -> Standard'. The main content area is divided into four sections:

- Line Voltage:** Radio buttons for 120V, 230V (selected), and Variable.
- Line Frequency:** Radio buttons for 50 Hz (selected) and 60 Hz.
- Time Parameters:** 'Test Duration' is set to 2 hours, and '# of Samples' is 22500.
- Device Class:** Radio buttons for Class A, Class B, Class C, and Class D (selected).

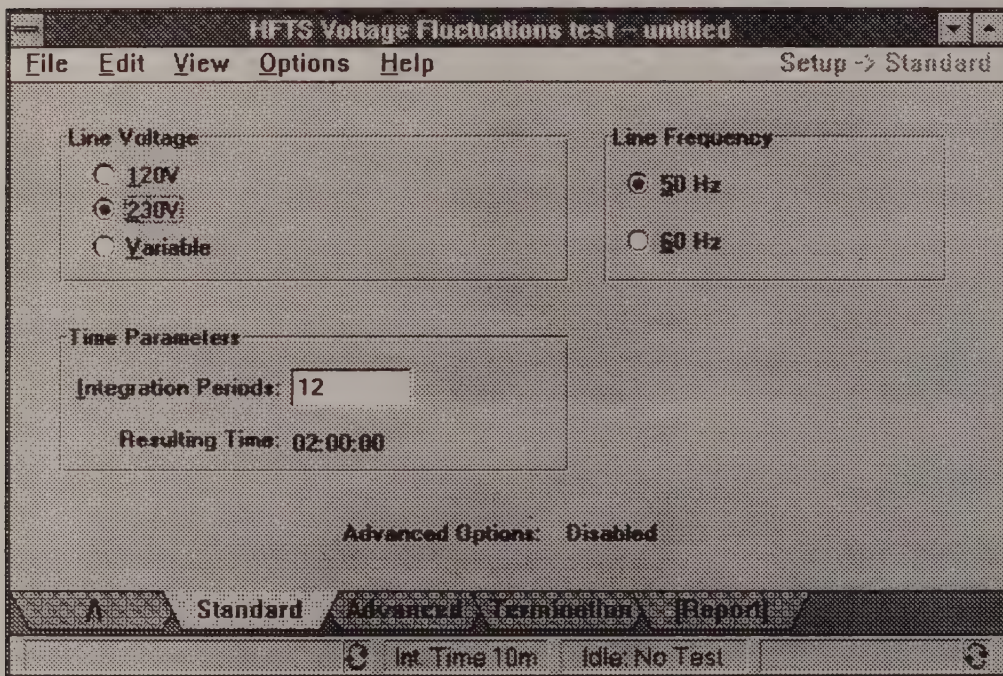
At the bottom, a status bar shows 'Advanced Options: Disabled'. Below this is a tabbed interface with 'Standard', 'Advanced', and 'Termination' tabs. The 'Standard' tab is active, displaying 'IEC Class D' and 'Idle: No Test'.

- Select the line voltage that you will be applying to the equipment under test. Selecting **Variable** lets you enter a value other than 120 Vac or 230 Vac.

Setting Up the Test

- ☐ Select the line frequency (50 or 60 Hz) that you will be applying to the equipment under test.
- ☐ Select the test duration in **seconds**, **minutes**, **hours**, or **days**.
The **# of data records** field displays the number of data records that will be collected during the test time that you have specified. Note that the relationship between time and the number of samples per second is a function of both line frequency and window type. The window type can be specified in the **Advanced Test Setup** window, and will be set to a default of **Rectangular** if the Advanced Options are disabled.
- ☐ Select the device class that you will be testing.

If you are testing Voltage Fluctuations
the following standard options are selectable:



- ☐ Select the desired line voltage that you will be applying to the equipment under test. Selecting **Variable** allows you to enter a value other than 120 Vac or 230 Vac.
- ☐ Select the line frequency (50 or 60 Hz) that you will be applying to the equipment under test.
- ☐ Select the number of integration periods to be acquired during the test. The **Resulting time** field displays the test duration based on the number of integration periods as well as the Pst integration time that you have specified in the Advanced window. The Pst integration time is set to a default of 10 minutes with the Advanced options disabled.

Select the Advanced Test Options

The "Advanced" options may be used to modify test conditions outside the range permitted for compliance tests. Any such selections can be made in the Advanced window. As a rule, you should not change the factory default settings if you are doing compliance testing because the changes will invalidate the test.

Note As exception to the above statement, the Current Measurement Range setting and the Current Limit settings may be changed without invalidating the compliance test, as long as the changed settings do not cause a current limit fault to occur **during** the test. Current limiting may occur during the time period when power is initially applied but before the test is run. This allows product that require high in-rush currents to be tested. The time delay can be specified in the Pre-test window. Current limit errors are detected and displayed if they occur during the test.

If you are testing Quasi-stationary or Fluctuating harmonics the following advanced test options are selectable:

The screenshot shows the 'HFTS Fluctuating Harmonics test - IEC555-2.FLU' window. The menu bar includes File, Edit, View, Options, and Help. A 'Setup -> Advanced' button is in the top right. The main area contains several sections of settings:

- Use System Defaults for Advanced Options:** A checkbox that is currently unchecked.
- Current Limit:**
 - RMS Limit:** 10.0 Amps (with a default checkbox).
 - Peak Current:** 30.0 Amps (with a default checkbox).
- Window Type:**
 - ☐ Rectangular
 - ☒ Hanning
 - ☐ Default
- Current Measurement Range:**
 - ☐ High
 - ☒ Low
 - ☐ Default
- Test Limit Overrides:**
 - Harmonic Failure Thresholds:** 120.00 % of spec (with a default checkbox).
 - Pre-test Data (Class D):**
 - Measured:** [redacted] Watts
 - Override:** 214.6 Watts (with a default checkbox).
- Measurement Delay:**
 - Apply Power:** 5 seconds before initiating measurements (with a default checkbox).

At the bottom, there is a tabbed interface with tabs for 'Standard', 'Advanced' (which is selected), 'Termination', and 'Display'. Below the tabs, a status bar shows: 'Elapsed: 0:00:02:00', 'Remaining: 0:00:00:00', 'IEC Class D', 'Idle: FAILED', and 'Failures: 4525'.

Setting Up the Test

- ☐ Select the rms current limit of the IEC Test System that you will be applying to the equipment under test. As a rule, it is best to leave these parameters set to their maximum default values. This is to prevent the 4801iL from going into current limit mode during a test run. If the source goes into current limit during a normal test, the test will be invalid. Default current limit values are automatically set to the maximum value of the 4801iL for the selected voltage range.
- ☐ Select the type of measurement window (Rectangular or Hanning)
- ☐ Select the peak current measurement range of the Harmonic/Flicker Test System

Low Range	9.6 A peak
High Range	96 A peak

The Low range is the best choice for testing low power equipment as it provides the most accuracy and resolution. However, you must make sure that the equipment under test never exceeds 9.6 A or the test results will be invalidated.

- ☐ Select a test limit override for the harmonic failure threshold. This is specified as a percent of the limit as defined by the applicable standard. For Class C, test limits are also a function of the measured (or user-specified) power factor and the line current at the fundamental frequency. If necessary, you can override the power factor measured in the pre-test. For Class D, test limits are also a function of real power (or watts). If necessary you can also override the watts measured in the pre-test. Overrides are useful to prevent minor changes in measured values from changing the test limits each time the test is run.
- ☐ Select a delay period from the moment power is applied to the equipment under test until the time that the IEC Test System starts measuring data. This delay may not exceed 10 seconds for compliance tests.

If you are testing Voltage Fluctuations

the following advanced test options are selectable:

HFTS Voltage Fluctuations test – IEC555-3.FLK

File Edit View Options Help Setup -> Advanced

☐ Use System Defaults for Advanced Options

Current Limit

RMS Limit: 13.0 Amps ☒ Default Peak Current: 80.0 Amps ☒ Default

Returned Data Type

☐ All ☐ Default

☐ Pst/RMS Summary ☐ Default

☒ RMS/Flicker Time Series

Pst Integration Time

☐ 1 minute ☒ 5 minutes ☐ Default

☐ 10 minutes ☐ 15 minutes

Test Limit Overrides

Pst/Plt Thresholds: 150.0 % of spec ☐ Default

RMS Thresholds: 120.0 % of spec ☐ Default

Measurement Delay

Apply Power: 6.0 seconds before initiating measurements ☐ Default

A Standard Advanced Termination (Display)

Elapsed: 0:00:02:00 Remaining: 0:00:00:00 Failures: 0

- ☐ Select the rms current limit of the Harmonic/Flicker Test System that you will be applying to the equipment under test. As a rule, it is best to leave this parameter set to its maximum default value. This is because although the function of the current limit is to protect the equipment under test, if the unit does go into current limit during a normal test, the test will be invalid.
- ☐ Select the returned data type (All, Pst/Rms summary, or Rms/Flicker time series)
- ☐ Select the Pst (or short-term) flicker integration time.
- ☐ Select an override for the Pst/Plt (short-term/long-term) flicker and Rms thresholds. This is specified as a percent of the specification in the applicable standard.
- ☐ Select a delay from the time power is applied to the equipment under test until the time that the Harmonic/Flicker Test System starts measuring data.

Select the Test Termination Options

Termination options let you select the conditions that will terminate the test. They are selected in the Termination window.

Setting Up the Test

If you are testing Quasi-stationary or Fluctuating harmonics the following termination options are available:

The screenshot shows the 'HFTS Fluctuating Harmonics test - IEC555 2.FLU' software window. The 'Termination' tab is selected. Under 'Test Termination Conditions', the following options are checked: 'On Error(s)', 'On Current Limit(s)', 'On Failures of Type: With 2.5-minute Window' (with 'Exceeding a count of: 8'), and 'On Watch Events exceeding a count of: 5'. The 'Watch Items' section shows 'Harmonic Selector: Odd <= 19', 'Harmonic Number: 1', and 'Threshold: Value > 120 % of spec'. The status bar at the bottom indicates 'Elapsed 0:00:02:00', 'Remaining 0:00:00:00', 'IEC Class D', 'Idle: FAILED', and 'Failures 4525'.

Test Termination Conditions

- ☒ On Error(s)
- ☒ On Current Limit(s)
- ☒ On Failures of Type: With 2.5-minute Window Exceeding a count of: 8
- ☒ On Watch Events exceeding a count of: 5

Watch Items

Harmonic Selector:	Harmonic Number:	Threshold:
Odd <= 19	1	Value > 120 % of spec

Standard Advanced **Termination** (Display)

Elapsed 0:00:02:00 Remaining 0:00:00:00 IEC Class D **Idle: FAILED** Failures 4525

- ☐ Termination on errors
- ☐ Termination when the current limit is exceeded
- ☐ Termination on exceeding a specified number of failures.
When testing **fluctuating harmonics** and this box is checked, you can specify the following failures:
 - of any type,
 - with a 2.5 minute window
 - without a 2.5 minute window.
- ☐ Select termination on exceeding a specified number of watch events. Each event that satisfies the selected criteria is counted as one event occurrence.

If termination on watch events is enabled, the following watch-event criteria can be selected:

- ☐ all harmonics greater than the specified percent of threshold
- ☐ odd harmonics greater than the specified percent of threshold

- ☐ odd harmonics $\leq$ 19 that are greater than the specified percent of threshold
- ☐ even harmonics greater than the specified percent of threshold
- ☐ a specific harmonic that is greater than the specified percent of threshold

If you are testing Voltage Fluctuations
the following termination options are available:

HFTS Voltage Fluctuations test -- IEC555-3.FLK

File Edit View Options Help Setup > Termination

Test Termination Conditions

☒ On Error(s)

☒ On Current Limit(s)

☒ On Pst Failures exceeding a count of: 5

☒ On RMS Failures of Type: Dmax Exceeding a count of: 5

☒ On Watch Events exceeding a count of: 5

Watch Items

Item: Flicker Threshold: Value > 100.06 Perceptibility Units

A Standard Advanced Termination (Display)

Elapsed: 0:00:02.00 Remaining: 0:00:00.00 Int Time 5m Failures: 0

- ☐ Termination on errors
- ☐ Termination when the current limit is exceeded
- ☐ Termination on exceeding a specified number of Pst failures
- ☐ Termination on exceeding a specified number of Rms voltage failures.
You can specify Rms voltage failures:
of any type
Dmax failures
Dc failures
Dt failures.

Setting Up the Test

- ☐ Termination on exceeding a specified number of watch events. Each event that satisfies the selected criteria is counted as one event occurrence.

If termination on watch events is enabled, you can select the following watch-event criteria:

- ☐ Pst values greater than the specified perceptibility units
- ☐ Summary Rms voltage values of the following types:
 - all values greater than the specified percent of threshold
 - Dmax values greater than the specified percent of threshold
 - Dmax values greater than the specified voltage threshold
 - Dc values greater than the specified percent of threshold
 - Dc values greater than the specified voltage threshold
 - Dt intervals greater than the specified time limitSummary values are the maximum value for each type within the presently displayed integration period.
- ☐ Instantaneous Flicker values greater than the specified perceptibility units

4

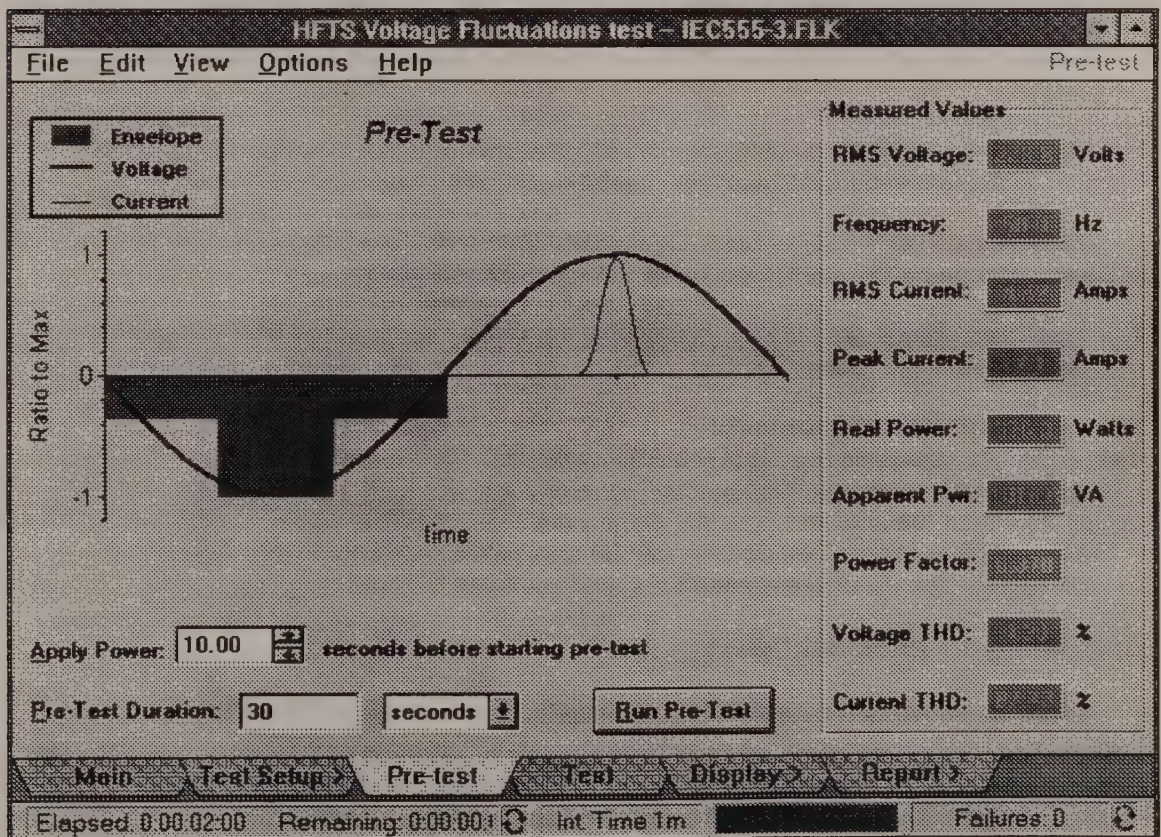
Running the Test

Before actual test data can be acquired, the pre-test must be executed. Once the pre-test data is available, the main test can be started. This is accomplished through the **Pre-Test** window and the **Test** window respectively. During a test run, progress information is displayed in the Status bar at the bottom of the screen.

To run a Pre-test

Note Running a pretest after opening a file that already contains data will not only overwrite the pretest data, but will also delete the existing test data.

1. Select the Pre-test tabs on the bottom of the screen to access the Pre-test window. Note that the Pre-test window is also available from the View Menu.



Running the Test

2. If desired, the time delay from when power is applied until the pre-test is run may be changed. The default value is 10 seconds.

3. Also, it is possible to increase the duration of the pretest itself. The purpose of running a longer pretest is to obtain more data over which the test results are averaged (see Specifying Pretest Duration.) The default pretest time is 10 seconds.

4. Press the Run Pre-test button to run the pre-test.

For Quasi-stationary and Fluctuating Harmonic tests,

the Pre-test checks if you have correctly classified your equipment as Class A or D in the Standard Test Setup window. It displays the input-current waveshape of the equipment under test which allows you to examine the waveshape for distortion.

The **Pre-test graph** displays the first half-period of the input-current waveshape superimposed on the Class D waveshape standard. Class D equipment must have input power less than or equal to 600W, and 95% of its input-current waveshape must fall within the Class D waveshape standard template.

The **Class Indicator** will show a green background if the data collected from the equipment under test matches the Class selection. If the data collected from the equipment under test does not match the Class selection, the Class indicator shows a red background. If this happens, return to the Standard Test Setup window, select the correct class, and rerun the pretest.

The **Percent in Envelope** indicator displays the percentage of waveform data within the Class D waveshape standard if Class A or Class D has been selected.

The **Voltage THD "IN SPEC" or "OUT OF SPEC"** indicator summarizes whether or not the individual voltage harmonics are within the standard's specification.

The **Measured Values** area on the right side of the display summarizes nine of the most common line input characteristics.

For the Voltage Fluctuations test,

the pre-test waveform display is not required by the IEC 1000-3-3 standard. It does however provide useful information about the input waveform and other line parameters for the equipment under test. For example, if there are any abnormalities in the input waveform, these will be apparent in this display. The tabular data that is displayed in this window provides a permanent record of the test conditions that existed at the time of the voltage fluctuations test.

Specifying a Pretest Duration

Pretest measurement data is collected through one of two distinct acquisition processes.

Average, rms, and peak measurements are based on a long-term acquisition process that is determined by the duration time specified in the Pre-test window. Varying the test duration time increases the amount of data upon which the measurements are based.

- Average measurements are made by acquiring N measurements, totaling the acquired values, and multiplying by 1/N.

- Rms measurements are made by acquiring N measurements, totaling the square of the values, multiplying by 1/N, and then taking the square root. Vrms and Irms values returned with the harmonic data are used to calculate Vrms and Irms over longer integration periods specified by the pretest duration control.
- Peak method measurements are made by returning the highest value obtained during the specified integration time. Voltage THD is calculated as follows : $THD = \sqrt{\text{sum}(\text{peak\_harmonics})^2} / V_{rms}$.
- The estimated peak current measurement is implemented by multiplying the integrated Irms value by the crest factor of the current waveform. Crest factor is calculated by dividing the peak value of the waveform by a one-shot rms current value obtained from the data record. The quality of this measurement is a function of the variability of the current waveform crest factor over the integration time used for the rms current measurement.
- VA and power factor measurements are made by using rms and average results in calculations

One-shot measurements on the other hand, are based on the acquisition of a single measurement, which is acquired from a single acquisition buffer. These types of measurements are not affected by the pre-test duration time.

The following table indicates the method used for each measurement.

Measurement	Method
Rms voltage	Rms
Frequency	One-shot
Rms current	Rms
Peak Current	Estimated
Real power	Average
Apparent power	Vrms x Irms
Power factor	Watts/VA
Voltage THD	One-shot
Current THD	One-shot
Voltage harmonics	Peak
Current waveform	One-shot

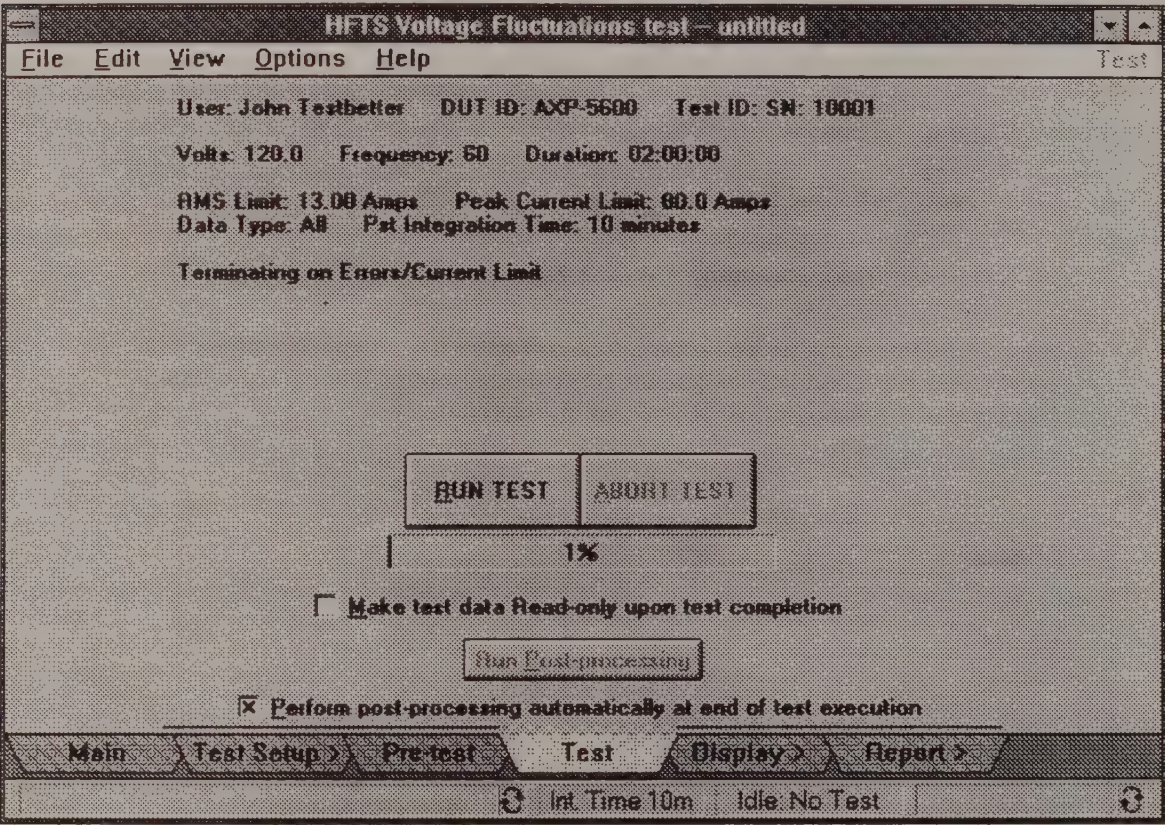
To run a Test

1. Select the Test tab at the bottom of the screen to bring up the Test window. Note that the Test window is also available from the View Menu.

2. You can instruct the HFTS software to save the data in a read-only file. Selecting this option will permit subsequent review and analysis of the test results, but will **prevent** running a new test that will overwrite the test data. This action may also be taken after the test is run by using the **Lock Test File** command in the File menu.

Running the Test

3. You can opt to run the post processing of test data immediately after the completion of the test, or at a later time. Post processing is required to generate test reports, and to generate data for the Statistics and Probability displays. Depending on the length of the test, the post processing of data may take considerable time.
4. Press the **Run Test** button to run the test.



The Test window displays a summary of the test setup for the selected test type. The progress bar on the screen indicates the remaining time until completion of the test. Pressing the **Abort** button lets you abort the test at any time.

Refer to the Status Bar on the bottom of the screen for more information about the test. The status bar contains the following information:

Elapsed:	This field displays the elapsed time of the test and the remaining time of the test. It may also display the number of data records that have accumulated since the start of the test and the number yet to be acquired.
Remaining:	
Records	 switches between Elapsed/Remaining time and number of Records.
IEC Class	During compliance testing for Quasi-stationary or fluctuating harmonics, this field displays the device class that you selected
INT:Time	

in the Standard test-setup window. During compliance testing for Voltage fluctuations, this field displays the Pst integration time that is specified in the Advanced test-setup window .

Idle
RUNNING

This field displays whether the test is idle or running. It also indicates if a test has been aborted.

Errors
Failures

This field displays a running total of errors and failures that occur when the test is running. Clicking **inside** this field with the mouse brings up a dialog box that displays a more complete report of failure types and errors.



switches between the number of Errors and the number of Failures.

5***Viewing Test Data***

During test runs, data is continuously acquired during a test run and displayed in the various Display windows. The scrollbar at the top of the display screens is used to scroll through the test record or search for specific test data samples.

For **Quasi-stationary** or **Fluctuating harmonics**, the following data display formats are available: Graph, Table, Time-Series, Statistics, and Probability. If you are testing **Voltage Fluctuations**, available display formats are: Pst, Probability, Distribution, RMS, and Flicker. Use the Menu Tabs on the bottom of the screen to access the various display windows. Note that you can also access the display windows from the View Menu.

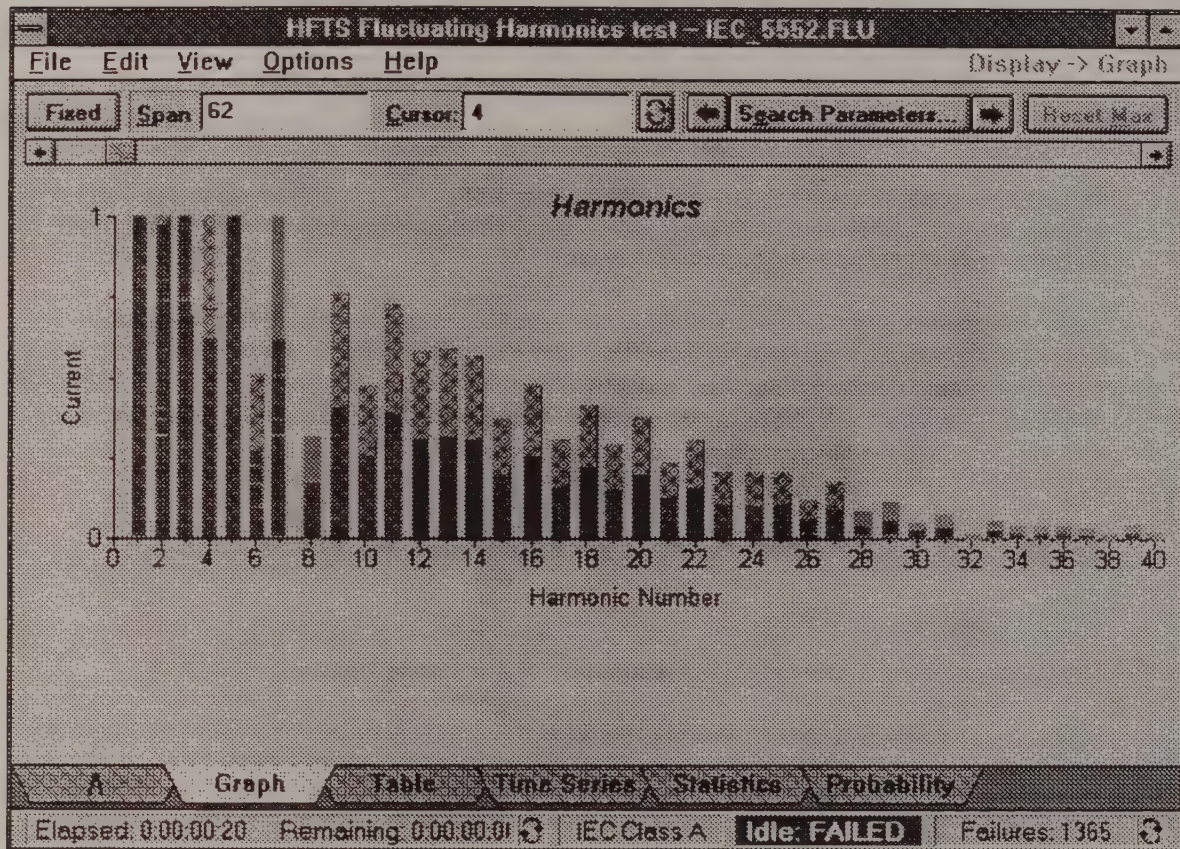
Viewing Quasi-stationary and Fluctuating Harmonics

Graph Display

The Graph display is used to view quasi-stationary or fluctuating harmonic data.

Note	The amount of test data displayed in the graph may be limited by the Span control. See "Using the Span Control" in chapter 6 for details.
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Viewing Test Data



The Graph display shows the following test data in a graphical format:

- ☐ **40 harmonics** along the X axis.
- ☐ the **absolute harmonic magnitude** along the Y axis.
- ☐ the **maximum measured value** of each harmonic at the top of each bar. When the test is running (rolling mode), this value is the maximum peak-hold value. After the test has finished, or if fixed mode is selected during a test run, this value is the maximum value within the selected span.

If the top of the bar is light green, it means that the maximum value is within the standard's specification. If the top of the bar is pink, it means that one or more measured values are outside the standard's specification.

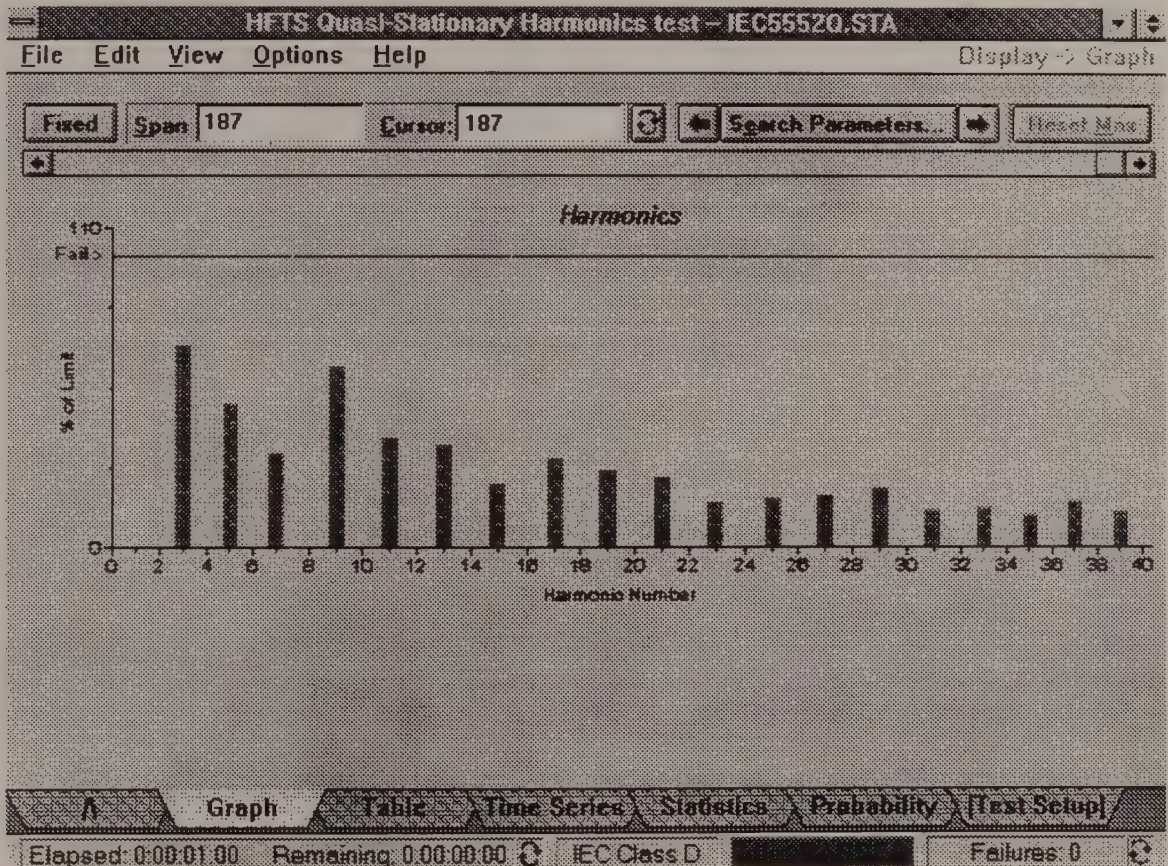
- ☐ the **present value** of each harmonic on the lower part of each bar. When the test is running (rolling mode), this value is always the latest measured value. After the test has finished, or if fixed mode is selected during a running test, this value is the value at the cursor location.

If the lower part of the bar is green, the present value is within the standard's specification. If the lower part of the bar is red, the present value is outside the standard's specification.

- **detailed information** on any bar can be obtained by holding down the **Shift** key and double-clicking on a bar. This highlights the selected bar in white and puts up a dialog box which displays a complete report of data points, failure types, and errors of the selected harmonic.

To **edit the graph**, click with the **right** mouse button on any area of the graph. This puts up the Edit Graph Attributes dialog box, which lets you configure items such as the graph axes, and the graph span. Refer to "Editing the Graph Attributes" later in this chapter for details.

For example, you can reformat the y axis to display the data in percent of the specification limits rather than in absolute values. In this case the display appears as follows:



The red line that appears across the display indicates the specification's limits. All values above the line are outside the specification's limits.

Viewing Test Data

Search Parameters

When the display is set to **Fixed**, you can perform search functions on specific test data. Search options allow you to:

Search for	specific items such as single failures 2.5 minute failures (only applies to fluctuating harmonics) all failures (only applies to fluctuating harmonics) harmonic magnitudes > than the specified value. If you select harmonic magnitudes > than the specified value, you can specify a value in either AMPS or as a % of Spec.
Harmonic Selection	for a harmonic type such as Odd Even Odd < = to 19 All harmonics Nth harmonic If you select Nth harmonic, you can specify a Harmonic Number .

Table Display

The Table display is used to show quasi-stationary or fluctuating harmonic data.

Note The amount of test data displayed in the table may be limited by the Span control. See "Using the Span Control" in chapter 6 for details.

	Limit	Amperes	%	Mean Amperes	Mean %	Max Amperes
1		1.9607		1.4432		2.1007
2		0.0182		0.0182		0.0404
3	0.8317	(1.7:47)	(296.2)	(1.2347)	(148.5)	(1.8439)
4		0.0150		0.0151		0.0339
5	0.4648	(1.4854)	(319.6)	(1.0730)	(230.9)	(1.5362)
6		0.0120		0.0119		0.0261
7	0.2446	(1.1843)	(484.1)	(0.8611)	(352.0)	(1.2711)
8		0.0076		0.0076		0.0164
9	0.1223	(0.8534)	(697.8)	(0.6282)	(513.6)	(0.9139)
10		0.0040		0.0043		0.0082
11	0.0856	(0.5338)	(623.5)	(0.4028)	(470.5)	(0.5693)
12		0.0027		0.0029		0.0049

Elapsed: 0:00:02:00 Remaining: 0:00:00:01 IEC Class D Idle: FAILED Failures: 4525

The Table display presents the following test data for each of the 40 harmonics in a tabular format:

- the standard's harmonic **limits** in the left-most column.
- the **magnitude** of the most recently measured harmonic in amperes and as a percent of either the standard's harmonic limits or the limits derived from the user-specified limit overrides.
- the **mean** in amperes and as a percent of the standard's limits.
- the **standard deviation** of each harmonic in amperes and as a percent of the standard's limits.

Viewing Test Data

- the **maximum peak** value of each harmonic in amperes **and** as a percent of the standard's limits.
- the **number of failures** for individual harmonics in the test to-date, as well as the number of failures for individual harmonics in the 2.5 minute window criteria.
- the failure count that exceeds **50%, 75% , 90%, and 95%** of the standard's limits.

Failures are indicated in red and are enclosed in parentheses. When the data is sent to a printer, failures are enclosed in parentheses.

Search Parameters

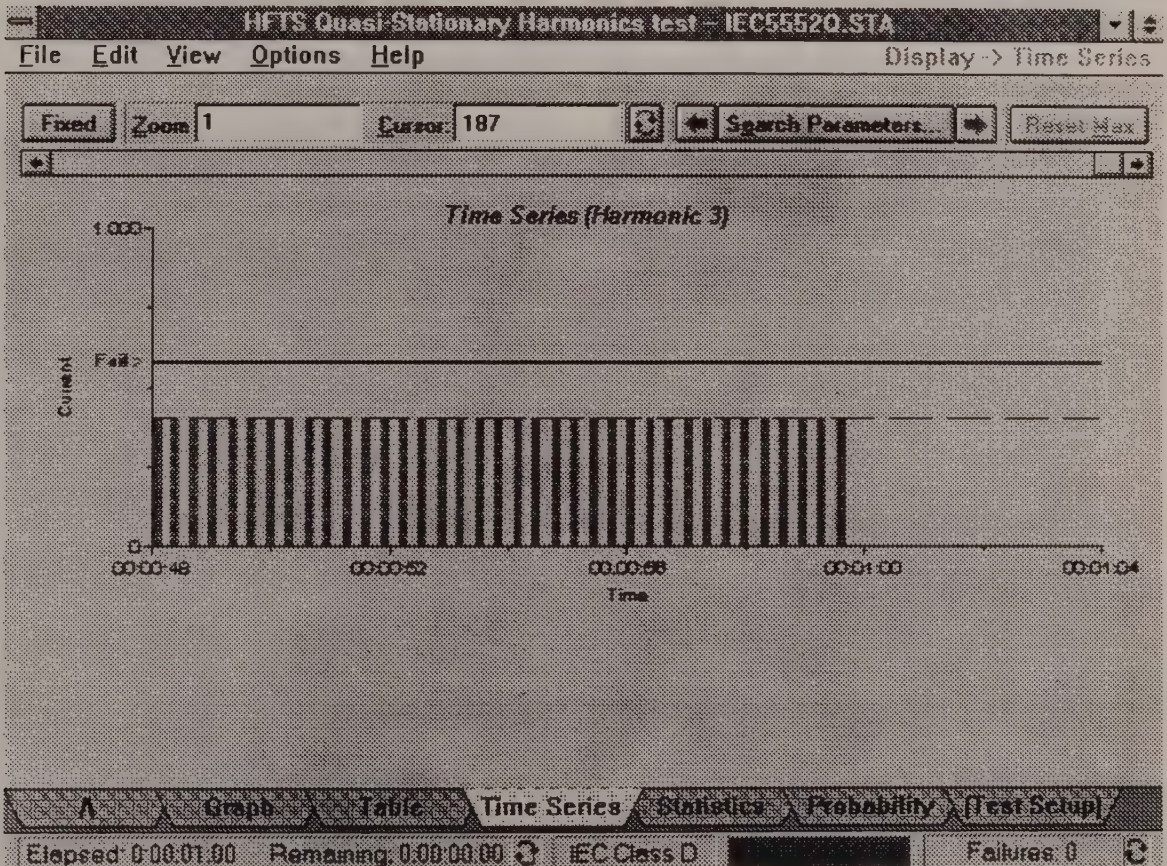
If the display is set to **Fixed** mode, you can perform search functions on specific test data. Search options let you:

Search for	specific items such as single failures 2.5 minute failures (only applies to fluctuating harmonics) all failures (only applies to fluctuating harmonics) harmonic magnitudes > than the specified value. If you select harmonic magnitudes > than the specified value, you can specify a value in either AMPS or as a % of Spec.
Harmonic Selection	for a harmonic type such as Odd Even Odd < = to 19 All harmonics Nth harmonic If you select Nth harmonic, you can specify a Harmonic Number .

Time-Series Display

The Time-series display is used to show quasi-stationary or fluctuating harmonic data.

Note Depending on the selected zoom factor, each bar may represent a single data point, or multiple data points. For example, if the zoom factor is 1:10, each bar represents 10 data points.



The Time-series display presents the following data for the **selected** harmonic:

- ☐ the **total time** of the selected span along the X axis.
- ☐ the **magnitude** of the specified harmonic along the Y axis (shown in absolute values).

If the bar is green, it means that the present value is within the standard's specification.
If the bar is red, it means that the present value is outside the standard's specification.

- ☐ You can **zoom** in on any area of the graph by drawing a zoom area with the left mouse button and then clicking inside the area. The zoom has a minimum range of one data point per bar, and a maximum range of 10 minutes within the total display window.

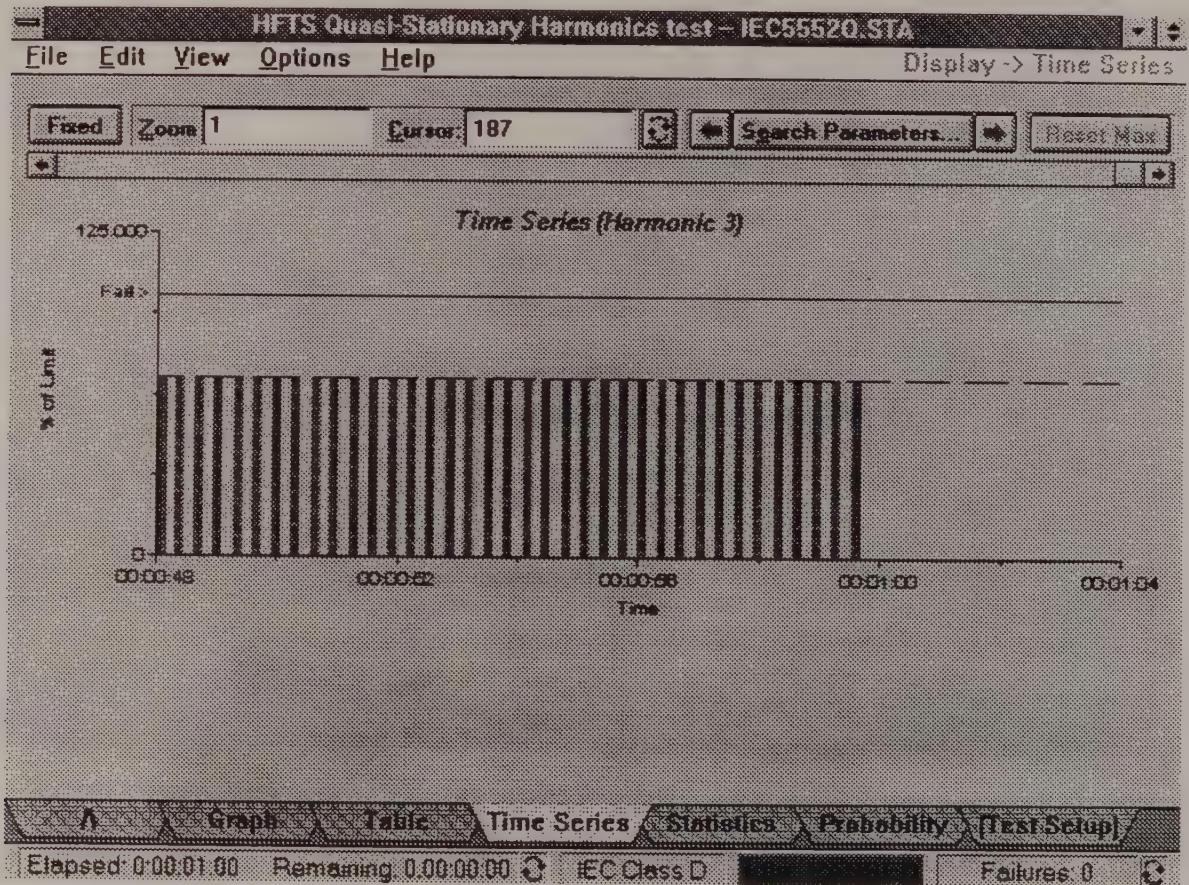
Viewing Test Data

The red line that appears across the display indicates the specification's limits. All values above the line are outside the specification's limits.

The blue line indicates the maximum measured value within the range selected by the zoom control.

To edit the graph, click with the right mouse button on any area of the graph. This brings up the "Edit Graph Attributes" dialog box. This dialog box lets you configure items such as the graph axes, the graph span, the zoom factor, and also lets you select a specific harmonic to review. Refer to "Editing the Graph Attributes" later in this chapter for details.

For example, you can reformat the y axis to display the data in percent of the specification rather than in absolute values. In this case the display appears as follows:



Search Parameters

If the display is set to **Fixed** mode, you can perform search functions on specific test data. Search options let you:

Search for	specific items such as single failures 2.5 minute failures (only applies to fluctuating harmonics) all failures (only applies to fluctuating harmonics) harmonic magnitudes > than the specified value. If you select harmonic magnitudes > than the specified value, you can specify a value in either AMPS or as a % of Spec.
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Viewing Test Data

Statistics Display

The Statistics display reflects a summary of the quasi-stationary or fluctuating harmonic data for the **entire** test.

Note: You must run post-processing in the Test window to generate data for this display.

HFTS Fluctuating Harmonics test – IEC555-2:FLU						
File Edit View Options Help				Display -> Statistics		
	Mean Amperes	Mean %	Std. Deviation	Std. Deviation %	Max Amperes	Max %
20	0.0014		0.0004		0.0028	
21	{0.1046}	{233.7}	0.0188	42.0	{0.1394}	{311.3}
22	0.0010		0.0004		0.0027	
23	{0.0716}	{175.3}	0.0103	25.3	{0.0909}	{222.4}
24	0.0015		0.0004		0.0025	
25	0.0337	89.6	0.0033	8.8	0.0387	102.8
26	0.0011		0.0004		0.0023	
27	0.0320	91.6	0.0027	7.7	0.0345	98.5
28	0.0010		0.0003		0.0020	
29	{0.0443}	{136.2}	0.0077	23.5	{0.0576}	{177.0}
30	0.0007		0.0002		0.0012	
31	{0.0424}	{139.9}	0.0092	30.2	{0.0561}	{191.6}
Elapsed: 0:00:02:00 Remaining: 0:00:00:1 IEC Class D Idle FAILED Failures: 4525						

The Statistics display presents the following data for each of the 40 harmonics:

- ☐ the **mean** in both absolute amperes and as a percent of the standard's limits for each harmonic.
- ☐ the **standard deviation** of each harmonic in both absolute amperes and as a percent of the standard's limits.
- ☐ the **maximum peak value** of each harmonic in both absolute amperes and as a percent of the standard's limits.
- ☐ the **number of failures** for individual harmonics as well as the number of failures for individual harmonics in the 2.5 minute window criteria.
- ☐ the failure count that exceeds **50%, 75%, 90%, and 95%** of the standard's limits.

Failures are indicated in red and are enclosed in brackets. When the data is sent to a printer, failures are enclosed in parentheses.

Viewing Test Data

Probability Display (for IEC-1000-3-2)

The Probability display for IEC-1000-3-2 shows the cumulative failure probability (or percentile) of the quasi-stationary or fluctuating harmonic data for the **entire** test.

Note: You must run post-processing in the Test window to generate data for this display.

HFTS Fluctuating Harmonics test – IEC555-2.FLU						
File Edit View Options Help				Display -> Probabilities		
	Mean Amperes	Mean %	Std. Deviation	Std. Deviation %	50th Amperes	50th %
1	1.4432		0.3997		1.4382	
2	0.0182		0.0073		0.0169	
3	(1.2347)	(148.5)	0.3696	44.4	1.2265	147.5
4	0.0151		0.0061		0.0139	
5	(1.0730)	(230.9)	0.3173	68.3	(1.0688)	(230.9)
6	0.0119		0.0045		0.0112	
7	(0.8611)	(352.0)	0.2485	101.6	(0.8572)	(350.5)
8	0.0076		0.0027		0.0071	
9	(0.6282)	(513.6)	0.1731	141.6	(0.6236)	(509.9)
10	0.0043		0.0012		0.0041	
11	(0.4028)	(470.5)	0.1009	117.8	(0.4000)	(457.2)
12	0.0029		0.0006		0.0028	
A Graph Table Unit Series Statistics Probability Test Setup Elapsed: 0:00:02.90 Remaining: 0:00:00.00 IEC Class D Idle: FAILED Failures: 4525						

The Probability display reflects the following data for each of the 40 harmonics:

- ☐ the **mean** in amperes and as a percent of the standard's limits for each harmonic.
- ☐ the **standard deviation** of each harmonic in amperes and as a percent of the standard's limits.
- ☐ magnitudes for the **50th, 90th, 95th, 99th, and 100th** percentiles in amperes and as a percent of the standard's limits.

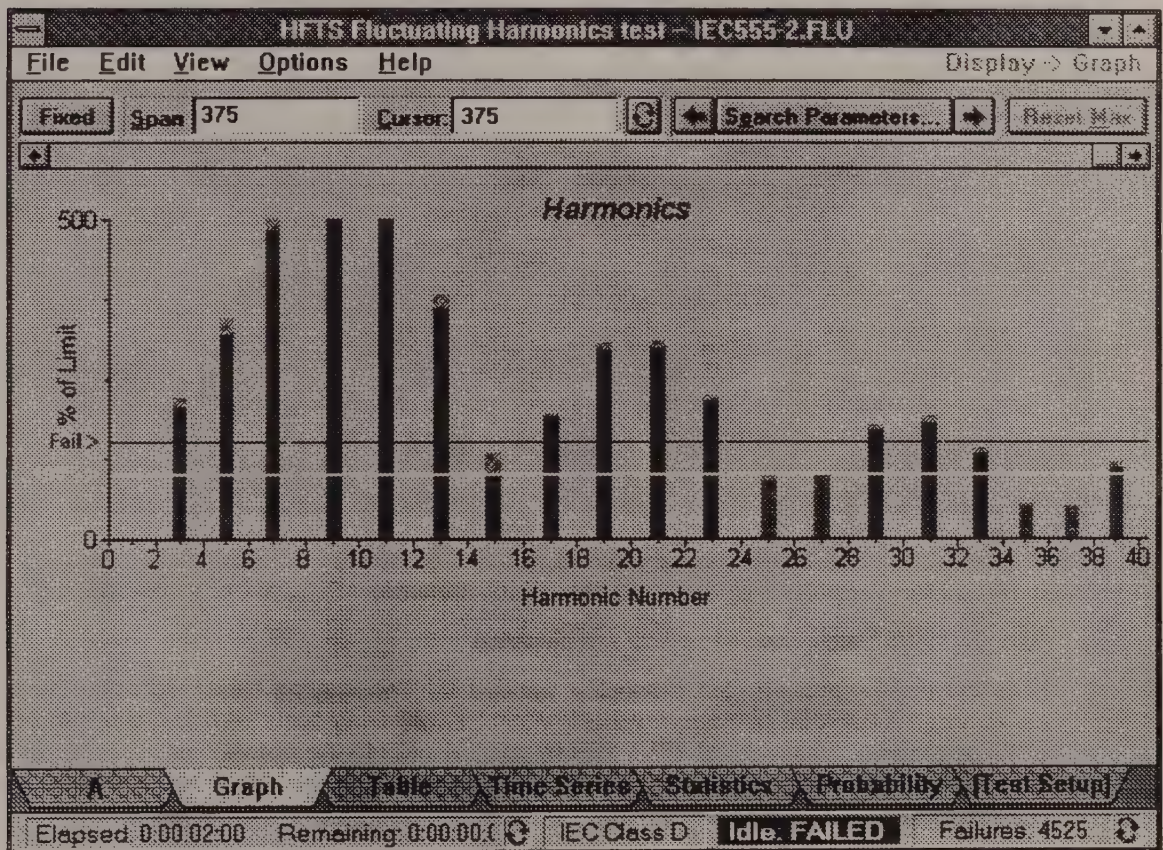
Failures are indicated in red and are enclosed in brackets. When the data is sent to a printer, failures are enclosed in parentheses.

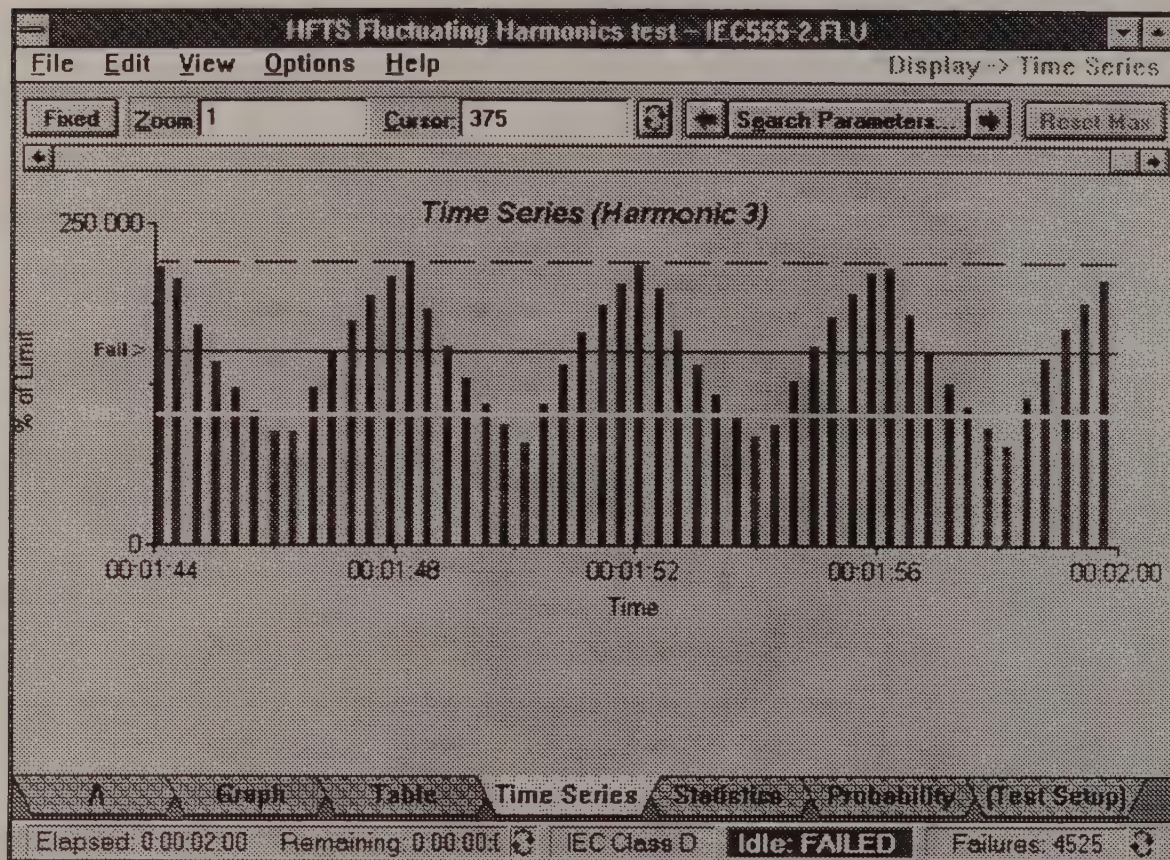
Viewing 2.5 Minute Window Failures

For fluctuating harmonics tests, limit values are more complex than those for quasi-stationary harmonics. The standard for fluctuating harmonics allows values up to 1.5 times the limits for quasi-stationary harmonics during a maximum of 10% of any observation period of 2.5 minutes. This corresponds to 15 seconds.

A 2.5 minute sliding window is used to check that values between 100% and 150% of the standard do not persist for more than 15 seconds in any 2.5 minute window period. If this limit is exceeded, then that particular harmonic has failed the test.

The 2.5 minute window appears in both the Graph and the Time Series displays.





The fluctuating harmonics failure band is defined by the area between the yellow line, which indicates 100% of the standard, and the red line, which indicates 150% of the standard.

- ☐ Bars that stop below the yellow line are always green.
- ☐ Bars that appear between the yellow line and the red line may be either red or green. A bar is green if the total number of values within the two lines occur during a time period of 15 seconds or less within the 2.5 minute window prior to the present cursor location. A bar is red if the total number of values within the two lines occur during a time period greater than 15 seconds within a 2.5 minute window prior to the present cursor location.
- ☐ Bars that continue above the red line are always red. These values have exceeded 150% of the standard and represent individual failures by themselves.

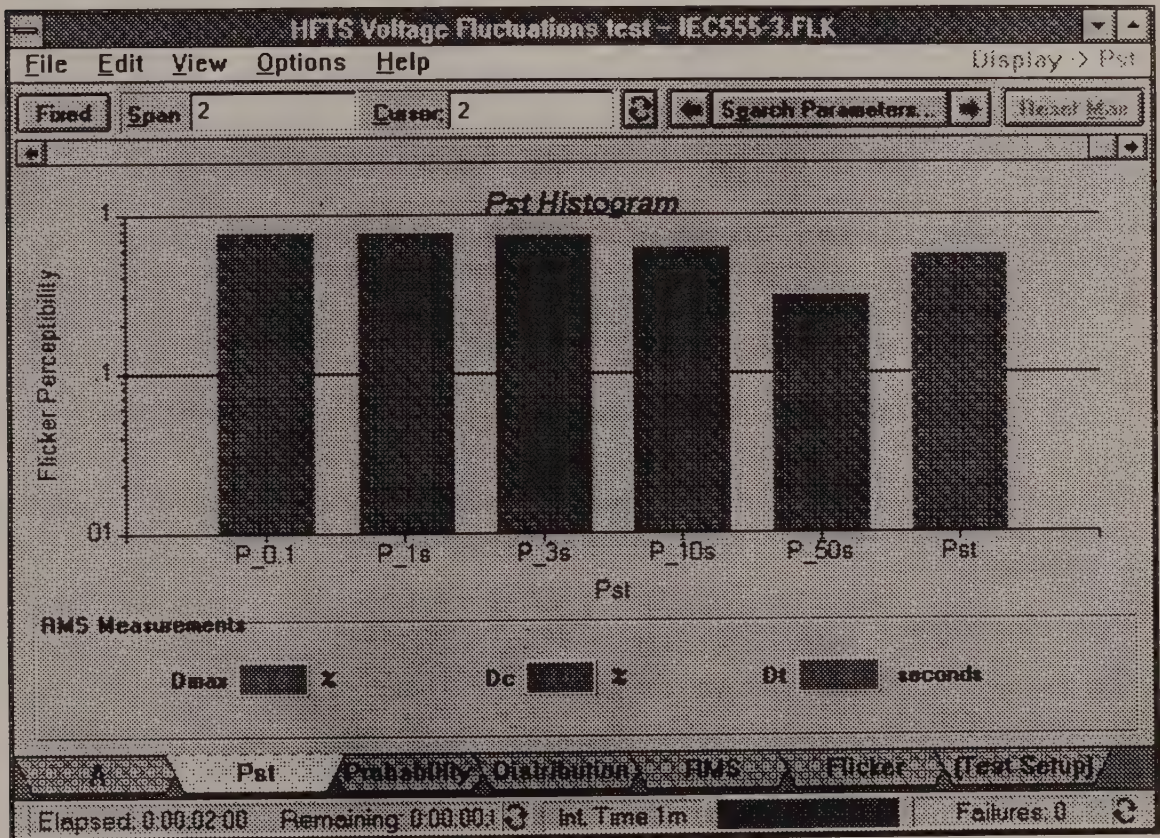
Important Values that exceed 150% of the standard are **not** included in the calculations that determine the maximum event count for 10% of any observation period of 2.5 minutes.

Viewing Voltage Fluctuations

Pst Display

The Pst display is used to view voltage fluctuations data.

Note The amount of test data displayed may be limited by the Span control. See "Using the Span Control" in chapter 6 for details.



The Pst display presents the following test data:

- ☐ Pst and the five component percentile values used to derive Pst for the selected observation period along the X axis.
- ☐ the **magnitude** of Pst and the component percentiles in flicker perceptibility units along the Y axis (Pst=1 is the threshold of perceptibility)
- ☐ the **maximum measured value** of each component at the top of each bar. When the test is running (rolling mode), this value is the maximum peak-hold value. After the test has finished, or when fixed mode is selected during a running test, this value is the maximum value within the selected span.

Viewing Test Data

If the top of the Pst bar is light green, it means that the maximum value is within the standard's specification. If the top of the Pst bar is pink, it means that one or more measured values are outside the standard's specification. The maximum component percentiles are always light green, since no failure criteria is specified for these by the IEC standard.

- the **present value** of each component on the lower part of each bar. When the test is running (rolling mode), this value is always the latest measured value. After the test has finished (fixed mode), this value is the value at the cursor location within the selected span.

If the lower part of the Pst bar is green, it means that the present value is within the standard's specification. If the lower part of the Pst bar is red, it means that the present value is outside the standard's specification. The component percentiles are always green, since no failure criteria is specified for these by the IEC standard.

- **detailed information** can be obtained by holding down the **Shift** key and double-clicking on the Pst bar. This puts up a dialog box which indicates the number of data points and number of failures in the selected observation period.
- the **Rms Measurement** area on the bottom of the screen provides a summary value of **Dmax**, **Dc**, and **Dt** failures

Summary values are the maximum value for each type within the presently displayed integration period

To **edit the graph**, click with the **right** mouse button on any area of the graph. This puts up the Edit Graph Attributes dialog box, which lets you configure items such as the graph axes, and the graph span.

Search Parameters

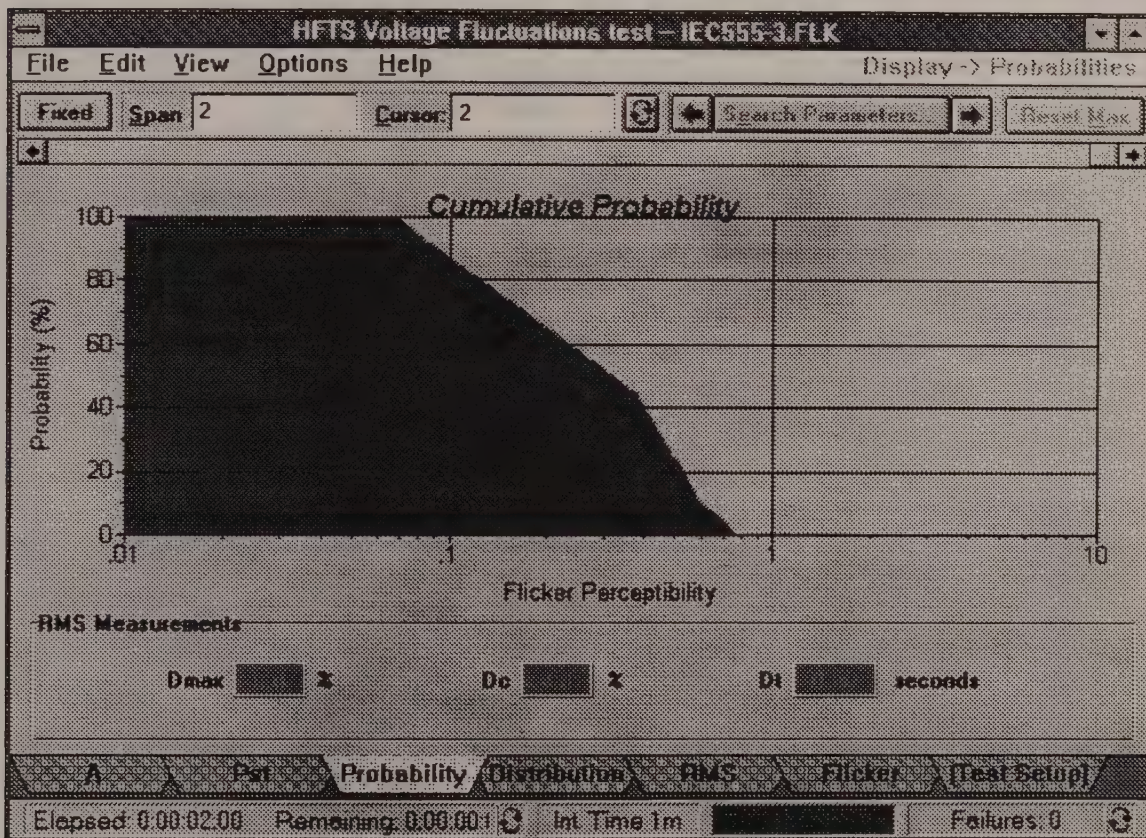
If the display is set to **Fixed** mode, you can perform search functions on specific test data. Search options let you:

Search for	specific summary items such as Pst according to perceptibility units Dmax as a percent of the nominal voltage Dc as a percent of the nominal voltage Dt by time threshold. You can specify searches by Failures , or by voltage Magnitudes > than the specified value.
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Probability Display (for IEC 1000-3-3)

The Probability display for IEC 1000-3-3 presents a summary of the cumulative probability of the voltage fluctuations data.

Note The quantity of test data displayed may be limited by the Span control. See "Using the Span Control" in chapter 6 for details.



The Probability display presents the following test data:

- the **magnitude** of the voltage change in flicker perceptibility units along the X axis (Pst=1 is the threshold of perceptibility). The value is the flicker perceptibility level that is exceeded for x% of the samples as indicated by the corresponding Y-axis values.
- the **cumulative probability** in percent along the Y axis. This data represents the flicker level associated with a given probability of occurrence. Stated another way, the data represents the percentile magnitudes for the total population of measured flicker levels in each Pst integration period. The dark green area represents the present value. The light green area is the peak value in the span. This graph does not display failures.
- the **Rms Measurement** area on the bottom of the screen provides a summary value of Dmax, Dc, and Dt failures.

Viewing Test Data

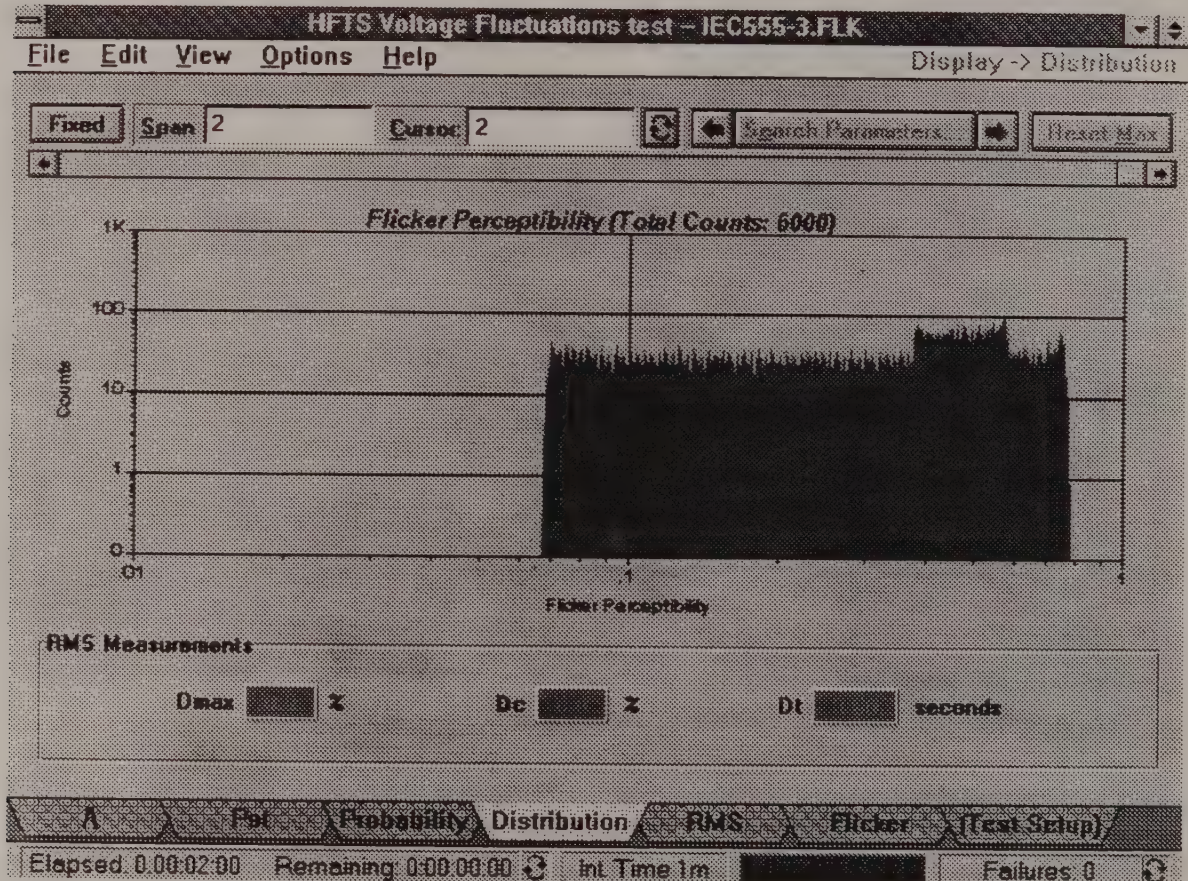
Summary values are the maximum value for each type within the presently displayed integration period.

To **edit the graph**, click with the **right** mouse button on any area of the graph. This puts up the Edit Graph Attributes dialog box, which lets you configure items such as the graph axes, and the graph span.

Distribution Display

The Distribution display presents a summary of the voltage fluctuations data.

Note The quantity of test data displayed may be limited by the Span control. See "Using the Span Control" in chapter 6 for details.



The Distribution display presents the following test data:

- the **magnitude** of the voltage change in flicker perceptibility units along the X axis (Pst=1 is the threshold of perceptibility)
- the number of **counts** along the Y axis. This data represents the distribution of instantaneous flicker levels associated with the 1024 logarithmically weighted bins that are accumulated for each Pst integration period. The dark green area represents the

present value. The light green area is the peak value in the span. This graph does not display failures.

- the **Rms Measurement** area on the bottom of the screen provides a summary value of Dmax, Dc, and Dt failures.

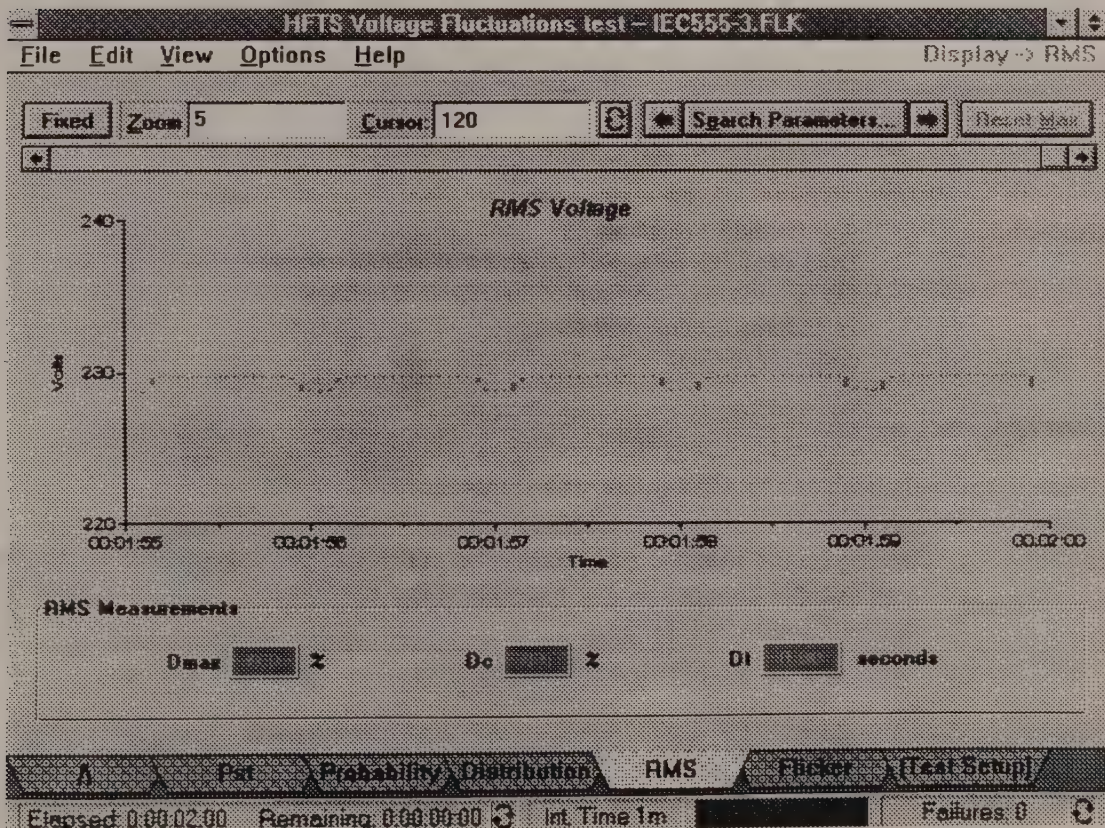
Summary values are the maximum value for each type within the presently displayed integration period.

To edit the graph, click with the **right** mouse button on any area of the graph. This puts up the Edit Graph Attributes dialog box, which lets you configure items such as the graph axes, and the graph span.

RMS Display

The Rms display is used to view the minimum and maximum values of summarized rms voltage data.

Note Depending on the selected zoom factor, each bar may represent a single data point, or multiple data points. For example, if the zoom factor is 1:20, each bar represents 20 data points.



Viewing Test Data

The Rms display presents the following test data:

- the **total time** of the selected range along the X axis.
- the **minimum** and **maximum** rms voltage values along the Y axis.

A green bar means that all values summarized by the bar are within the standard's specification. A red bar means that one or more values summarized by the bar are outside the standard's specification.

- the **Rms Measurement** area on the bottom of the screen provides a summary value of **Dmax**, **Dc**, and **Dt** failures.

Summary values are the maximum value for each type within the presently displayed integration period.

- You can **zoom** in on any area of the graph by defining a zoom area with the left mouse button and then clicking inside the area. Zoom factors increment in steps of five, for example 1:1, 1:5, 1:10, and so on. **Note** that the zoom has a minimum range of one data point/bar (one second), and a maximum range equivalent to the Pst integration time. Integration times of 1, 5, 10, or 15 minutes can be specified in the Advance Test Options window.

To **edit the graph**, click with the **right** mouse button on any area of the graph. This puts up the Edit Graph Attributes dialog box, which lets you configure items such as the graph axes, the graph span, and the zoom factor.

Search Parameters

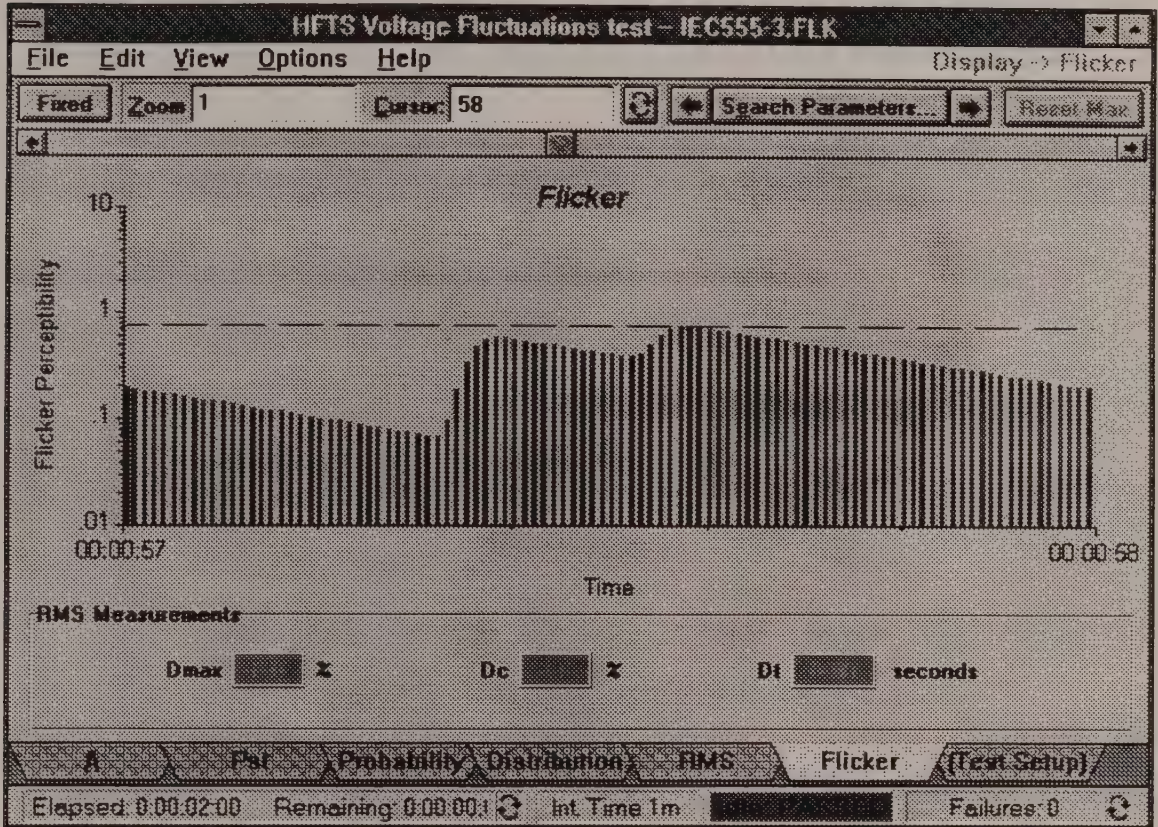
If the display is set to **Fixed** mode, you can perform search functions on specific test data. Search options let you:

Search for	specific items such as
	Dmax failures as a percent of the nominal voltage
	Dc failures as a percent of the nominal voltage
	Dt failures by time threshold
	Any failures.

Flicker Display

The Flicker display is used to show the values of instantaneous flicker data.

Note	Depending on the selected zoom factor, each bar may represent a single data point, or multiple data points. For example, if the zoom factor is 1:20, each bar represents 20 data points.
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The Flicker display presents the following data:

- ☐ the total time of the selected range along the X axis.
- ☐ the **magnitude of the voltage change** in flicker perceptibility units along the Y axis (Pst=1 is the threshold of perceptibility)

This graph does not display failures.

- ☐ the **Rms Measurement** area on the bottom of the screen provides a summary value of Dmax, Dc, and Dt failures.

Summary values are the maximum value for each type within the presently displayed integration period.

- ☐ You can **zoom** in on any area of the graph by defining a zoom area with the left mouse button and then clicking inside the area. **Note** that the zoom has a minimum range of one data point/bar (one second), and a maximum range of one Pst integration time.

To edit the graph, click with the right mouse button on any area of the graph. This puts up the Edit Graph Attributes dialog box, which lets you configure items such as the graph axes, the graph span, and the zoom factor.

Viewing Test Data

Search Parameters

If the display is set to **Fixed** mode, you can perform search functions on specific test data. Search options let you:

Search for	specific items such as Flicker according to perceptibility units
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Editing the Graph Attributes

To change the attributes or the settings of any of the graphs, proceed as follows:

Click with the **right** mouse button on any area of the graph.

This puts up the Edit Graph Attributes Dialog box.

From this dialog box you can select:

- ☐ the **Maximum** values of the X and the Y axes. These are specified in the units that are presently displayed on the axes. The X axis is not configurable in all graphs. In the Rms graph for example, only the Y axis is configurable for minimum and maximum voltage.
- ☐ the **Y Axis Values** as either a percent of the specification's limits, or as an absolute value in the units that apply to the presently displayed graph.
- ☐ either the **Span** of the data, from which you can specify:
Entire Test; the data range of the entire test
Custom; a range of time or data records
- ☐ or the **Zoom** factor of the graph. You can zoom in on any selected area of the graph by selecting an area with the left mouse button and double-clicking inside the area.
- ☐ a time-series harmonic, which is specific to the time series graph.

Viewing Reports

Reports are available in either short or long form and can be pre-viewed through the Report window. User Remarks can be added to a test data file by selecting the "Remarks" tab. The Menu Tabs at the bottom of the screen let you quickly access each area.

The **Printer** button sends your report to the default printer.

Note: You must run Post processing to generate data for the long form reports.

Remarks Report

The remarks report can be used to add any descriptive information about the test to the data file. These remarks are appended to both the short form and the long form report when printed.

After entering or editing the Remarks, click on **Save** to save the remarks to the present test data file.

Short Form Report

The short form report includes summary information about the current test. It includes:

- ☐ Heading information
- ☐ Final Test Result
- ☐ Settings and Conditions (with compliance or non-compliance indicated)
- ☐ Test Equipment Used
- ☐ Test Equipment Settings
- ☐ Pre-test Results for Class determination (not included for Voltage Fluctuations tests)
- ☐ Total Number of Failures
- ☐ Total Number of Errors
- ☐ Remarks (appended to the report when printed)

Long Form Report

For Quasi-stationary and Fluctuating Harmonic tests,
the long form report presents tabular information about the current test.

Part 1 of the report includes similar information as the short-form report but provides more information under Test Equipment Settings and Pre-test Results for Class A Determination.

Part 2 of the report includes the Final Test data, which consists of all of the information in the Harmonics table.

Part 3 of the report includes the Final Test Statistics, which consists of all of the information in the Statistics table.

Remarks are appended to the report when it is printed.

For Voltage Fluctuations tests,

the long form report presents tabular information about the current test.

Part 1 of the report includes similar information as the short form report but provides more information under Test Equipment Settings.

Part 2 of the report includes all Final Test Data by integration period.

Note	Depending on the number and the length of the integration period, the Final Test Data By Integration Periods of the report may include up to several dozen pages of information.
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Any remarks add by the user are appended to the report when it is printed.

Searching for Specific Test Data

The toolbar on the top of each display screen, which will be referred to as the **data navigator** in this chapter, is used to search for specific data in the test record. There are two ways to search for specific test data.

While the test is running

Using the data navigator while a test is running may prove to be slow unless you have a very fast PC with a lot of memory. This is caused by the constant processing of incoming data from your Harmonic/Flicker Test System. If this process proves to be too slow on your PC, you may choose to wait until the test has completed to before using the data navigator.

1. Click on the **Rolling** button to stop updating the display. Clicking on “Rolling” changes the button to “Fixed”.
2. Search for specific data by one of the following methods:
 - ❑ Click on the **Search Parameters** button. Select a specific item to search for in the dialog box that appears on the screen. Use the red **←** and **→** buttons to search in either time direction for the specified item.
 - ❑ For the Harmonics graph and table display, the Pst display, the Probability display, and the Distribution display, enter a **span** and a cursor location to examine the portion of the test record that is of interest.
 - ❑ For the Time Series, Rms, and Flicker displays, hold down the **left** mouse button to **zoom in** on a specific area of the graph.
3. Click on the **Fixed** button to return the display to “Rolling”, where it resumes being updated with the latest data.

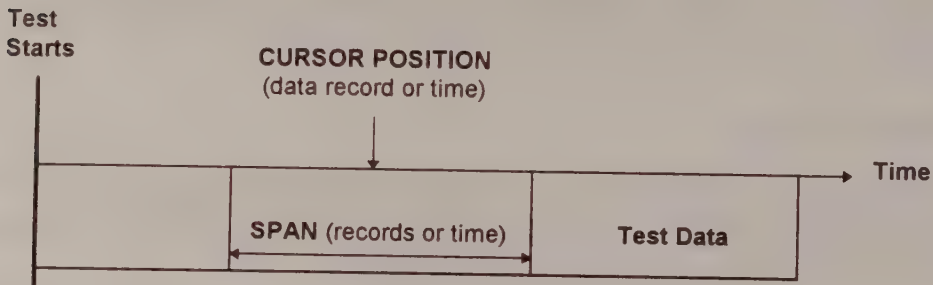
After the test has completed

Search for specific data by one of the following methods:

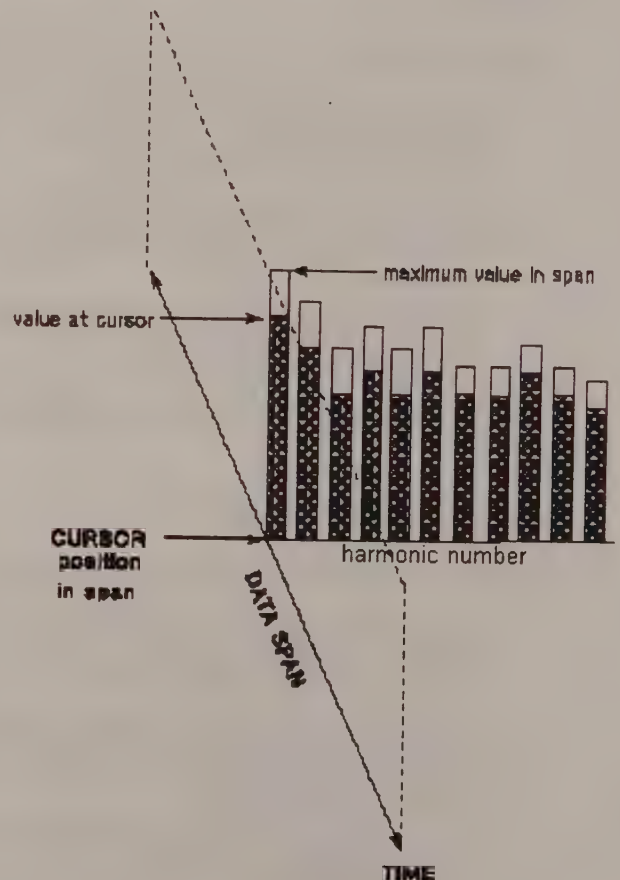
- ❑ Click on the **Search Parameters** button. Select a specific item to search for in the dialog box that appears on the screen. Use the red **←** and **→** buttons to search in either time direction for the specified item.
- ❑ For the Harmonics graph and table, the Pst display, the Probability display, and the Distribution display, enter a **span** and a cursor location to examine the portion of the test record that is of interest.
- ❑ For the Time Series, Rms, and Flicker displays, hold down the **left** mouse button to **zoom in** on a specific area of the graph.

Using the Span Control

The span control applies to the Harmonics graph and table displays, the Pst display, the Probability display, and the Distribution display. It determines the range of test data that you want to examine in relation to the present cursor location. This is illustrated in the following figure.



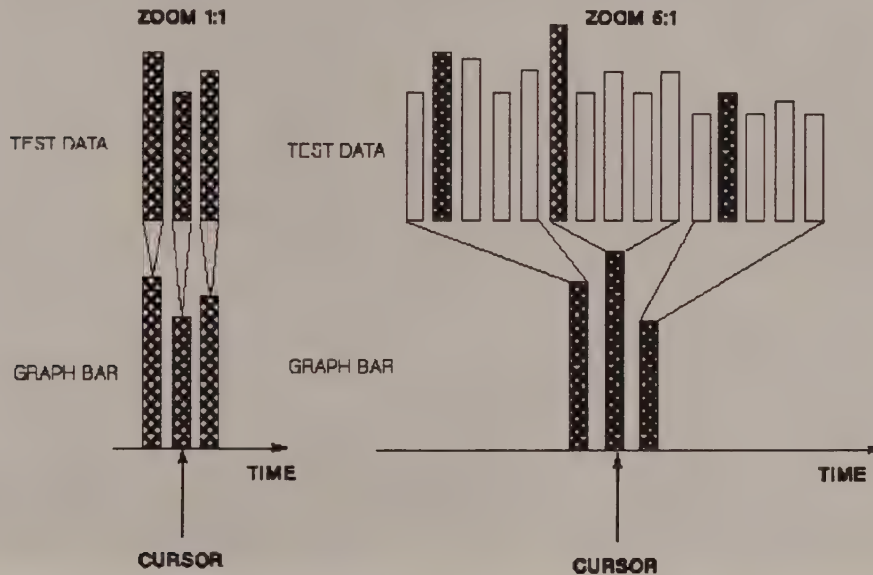
As is depicted in the following figure, the lower part of each bar (either dark green or red), indicates the value at the present cursor position. The top part of the bar (either light green or pink), indicates the maximum measured value of the entire data span. When you increase or decrease the span, you affect the range of data for which the maximum value is displayed. Note that changing the span does not affect the value at the present cursor position.



Zooming in on the Data

The zoom control applies to the Time Series display, the Rms display, and the Flicker display. The time-series display only shows a limited number of data bars. Zooming in lets you study individual data points in the time series. Zooming out lets you see summarized information for larger blocks of data.

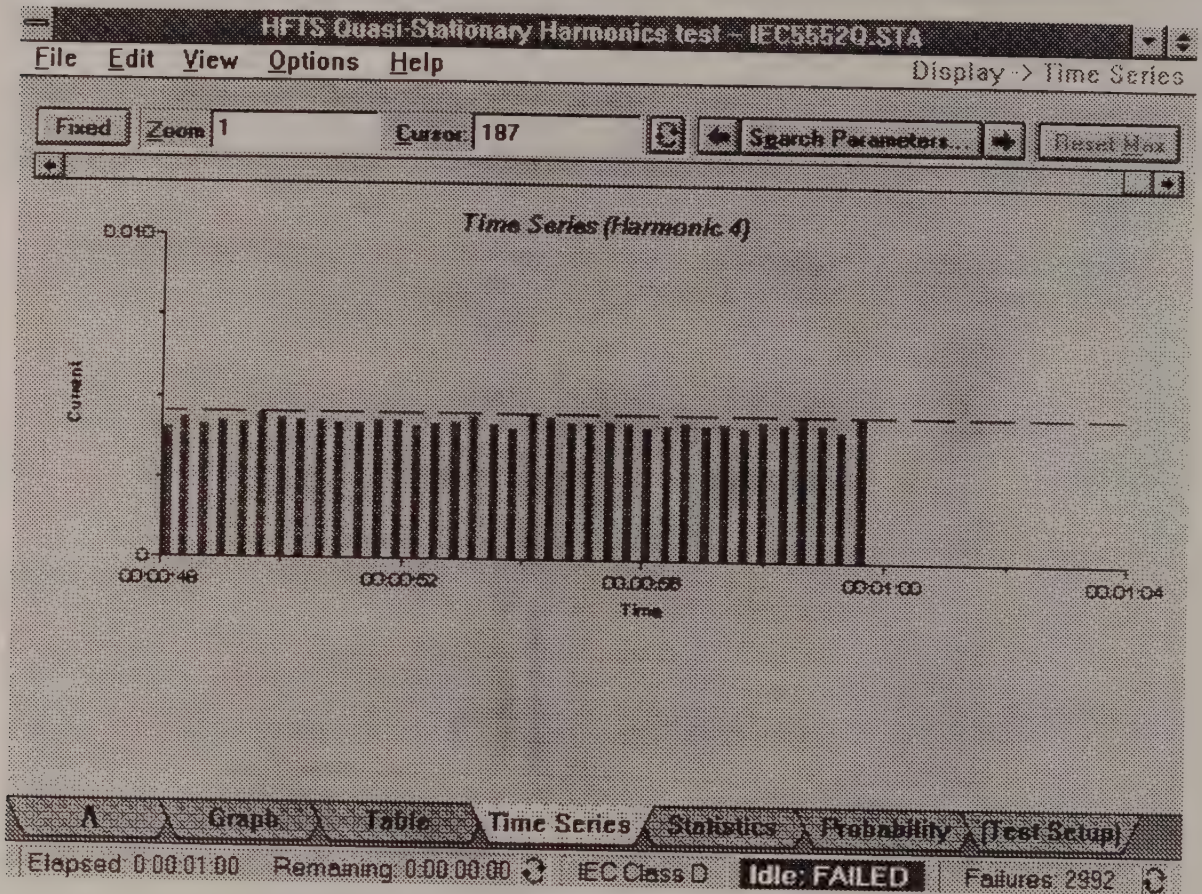
When the zoom factor is greater than 1:1, each bar represents the maximum value of two or more data points. This is illustrated in the following figure



To use the zoom control,

1. Hold down the **left** mouse button and drag the cursor to define an area on the graph on which to **zoom in** on.
2. Draw a rectangle outlining the area that you want to zoom in.
3. When you double-click **inside** the rectangle you just drew, the area inside it will zoom in and fill the present display area.
4. To zoom back out, click on any area of the display **outside** the graph.

Searching for Specific Test Data

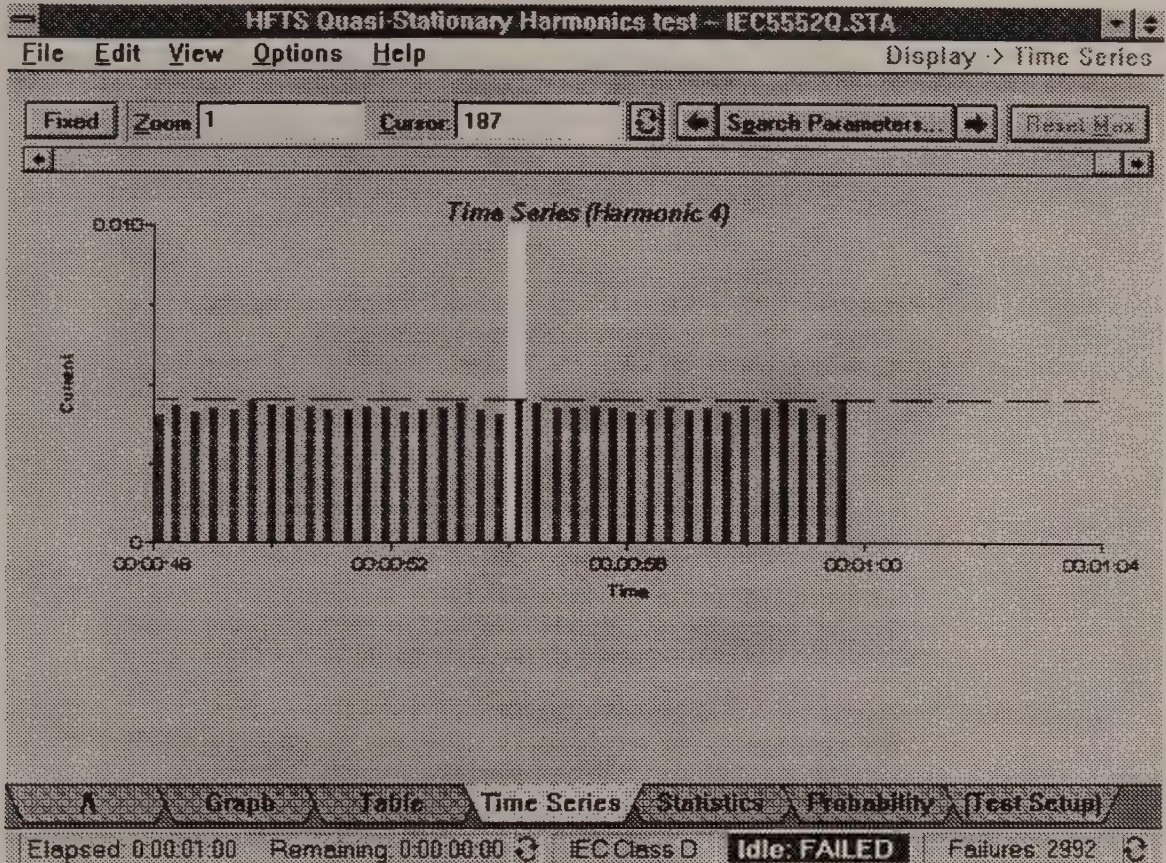


Obtaining Detailed failure and Error information

For detailed failure and error information about a specific bar in a graphical display, proceed as follows:

1. Press the **Shift** key
2. While holding down the shift key, click on the bar for which you desire more information with the left mouse button.

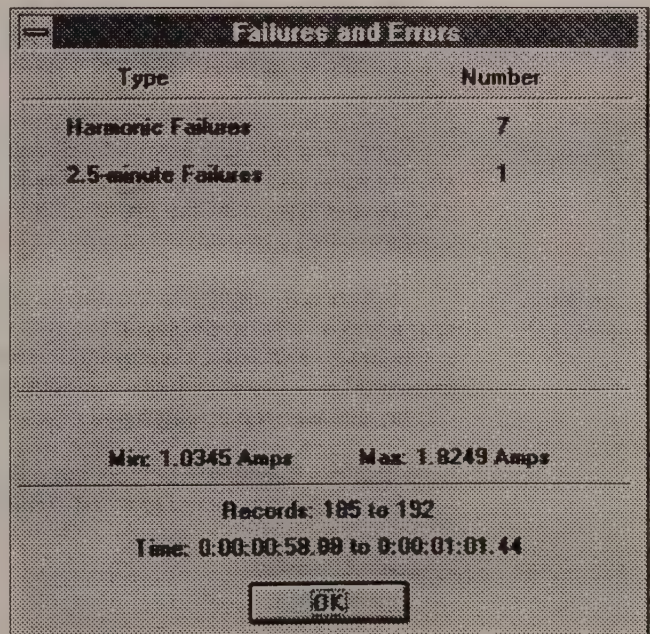
The following figure shows how a data bar is highlighted after it has been selected.



3. While still holding down the shift key, double-click on the highlighted bar with the left mouse button.

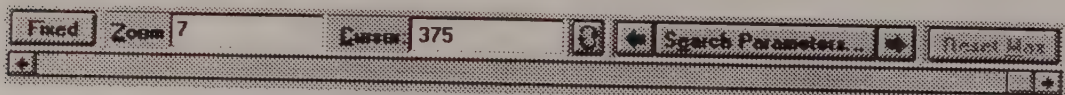
An information box similar to the following box will appear. This box contains information such as:

- ☐ the type and total number of failures
- ☐ the value at the present cursor location as well as the minimum and maximum values in the data span
- ☐ the size of the data span by records and by time



Data Navigator Controls

The data navigator bar contains the following controls:



Rolling | Fixed

This control toggles between Rolling and Fixed mode. **Rolling** mode indicates that the display is continually being updated with the latest data. **Fixed** mode indicates that either the test has completed, or the display is not presently being updated with new data. If a test is underway, the test is still busy collecting data in the background although the display has stopped updating.

Clicking on Rolling stops updating the display and changes the control to "Fixed".

If a test is presently underway, clicking on Fixed returns the display to "Rolling", where the display resumes being updated with the latest data. When the test has completed the control remains set to "Fixed".

Zoom | Span

This field is only active when the display is set to Fixed.

Span lets you specify the range of test data that you want to examine. The span can be specified in units of time (seconds, minutes, or hours) or by record number.

Zoom lets you zoom in on individual data values in the test data.

Clicking on  switches between units of time and record number.

Cursor

This field is only active when the display is set to Fixed. It lets you position the cursor in a specific location in the test data. You can position the cursor at a specific time, or at a specific data record.

Search Parameters

This control is only active when the display is set to Fixed. It puts up a dialog box that lets you search for specific items in the test data that you are presently viewing. Clicking on the red  button initiates a search backward in time from the present cursor location. Clicking on the red  button initiates a search forward in time from the present cursor location.

Reset Max

This control only applies to the harmonic Graph and Table displays. It is only active when the display is set to Rolling. It resets the maximum values in the Graph and Table displays to the to the present value, which eliminates any previous peak hold settings. The mean values in the Table display are also recalculated when this button is pressed.

Note that this button only affects the display; it does not change any of the test data that is being stored in the database by the present test.

Scroll Bar

The scroll bar is only active when the display is set to Fixed. It lets you access **all** of the data in the test. Clicking on the black ← and → buttons slides the scroll button □ through the data. Each time the ← and → buttons are clicked, the cursor moves one data record. You can also click on the scroll bar to move the button through the data, or drag the □ button directly. Each time the scroll bar is clicked, the cursor moves one span width.

7

Printing

Printing Graphs and Tables

Any data display graph can be printed from the File menu by selecting the Print command. The procedure for this is as follows:

From the File menu

1. Display the graph or table that you want to print using either the file menu keys or the appropriate menu tabs on the bottom of the screen.
2. Select the **Print Graph/Table** command from the File menu.
3. In the Print Report dialog box, select the page range, the print quality, the number of copies, if you want collated copies, or if you want to send the information to a file.
4. If you have access to more than one printer, click on the **Select** button to choose a different printer.

Printing Reports

Reports can be printed in one of two ways as described below. It is also possible to save a report to an ASCII text file, which can then be edited using a word processor.

To print from the File menu

1. Select the **Print Report** command from the File menu.
2. Select the type of report in the Choose Report dialog box (Short form or Long form).
3. In the Print Report dialog box, select the page range, the print quality, the number of copies, and if you want collated copies.
4. If you have access to more than one printer, click on the **Select** button to choose a different printer.

To print from the Report window

1. Select a Report window from either the View Menu, or the Report menu tabs. (Short form or Long form).
2. In the Report window, click on the **Print** button. The entire report will automatically be sent to your default printer.

To send a report to a file

Printing

1. Select the **Print Report** command from the File menu.
2. Select the type of report in the Choose Report dialog box (Short form or Long form).
3. In the Print Report dialog box, check the box labeled **Print to File**.
4. Enter a filename in the dialog box that appears on the screen. The report will be saved in ASCII format.

A

Specifications

Supported IEC 555-2 Standards

IEC 555-2	77A(CO)41
EN 60555-2	EN 61000-3-2
IEC 1000-4-7	IEC 1000-3-2

Supported IEC 555-3 Standards

IEC 725	IEC 1000-4-7
IEC 555-3	77A(CO)38
IEC 868	EN 61000-3-3
IEC 868 Amendment 1	IEC 1000-3-3
EN 60555-3	

PC Requirements

Minimum:	486DX 33 Mhz 8 Mbytes of RAM 210 Mbyte IDE Hard Disk (5 Mbytes required for installation) Windows 3.1, 3.11 or Windows for Workgroups Networking disabled
Recommended:	486DX4 100 Mhz or Pentium 16 Mbytes of RAM 1.2 Gbyte IDE PCI Hard Disk (5 Mbytes required for installation) Windows 3.1, 3.11 or Windows for Workgroups Networking disabled

Specifications

Supported GPIB Interfaces

National Instruments AT-GPIB/TNT

HP82335B GPIB Interface

Supported Equipment

4801iL IEC Test System (253 V, 16 Arms max., single-phase)

Equipment Specifications (IEC Mode)

IEC mode specifications are warranted over the ambient temperature range of 0 to 40° C. Unless otherwise noted, specifications are for a sine wave with a resistive load at an output frequency of 50 Hz or 60 Hz.

Model	4801iL
Maximum Output Ratings	
Output Power	4800 VA
rms Voltage	150 V (low range) 300 V (high range)
rms Current	32 A (low range) 16 A (high range)
Peak Current	96 A (low range) 48 A (high range)
Output Frequency	50 Hz/60 Hz
Load Regulation	0.5% of full scale
Line Regulation	0.3% of full scale
Maximum Voltage THD	1%
Reference Impedance Accuracy	3% @ 0.4 Ω and 796 μH 1% @ 0.4 Ω , 796 μH , and 25° C
Ripple & Noise (20 kHz - 10 Mhz)	
Vrms relative to full scale	- 60 dB
Vrms	300 mV
Output Voltage Harmonic Content	Compliant with IEC 868 and IEC 1000-3-2
Programming Accuracy	
rms Voltage	0.15% + 0.3 V
Frequency	0.01% + 10 mHz
Measurement Accuracy	
Current Fundamental	
low range	0.03% + 3 mA
high range	0.05% + 6 mA
Current Harmonics 2-40	
low range	0.03% + 2 mA + 0.2%/kHz
high range	0.05% + 3 mA + 0.2%/kHz
rms Voltage	0.05% + 250 mV
Power (VA) low range	0.15% + 1.8 VA
Power (VA) high range	0.15% + 9 VA
Power (W) low range	0.15% + 1.8 W
Power (W) high range	0.15% + 9 W
Measurement/Generation Synchronization Error	< 1 ppm
Current Shunt Burden	0 volts
Harmonic Smoothing Filter Time Constant	1.5 seconds
Pst Integration Time	1, 5, 10, or 15 minutes

Specifications

Ac Input Ratings and supplemental information (*input power configuration for the standard unit)

Model	4801iL
Voltage Range (Vac)	180 - 254 V _{L-L} (3Φ)* 342 - 456 V _{L-L} (3Φ)
Maximum Input Current (rms)	25 A per phase 15 A per phase
Input Power (max)	8900 VA/6550 W
Input Frequency	47 - 63 Hz
Net Weight	87.7 kg (193 lb)
Shipping Weight	127.3 kg (280 lb)

B**Glossary****Data Files**

Data files may contain the following types of data:

- ☐ test setup (or template) information only
- ☐ test setup and pre-test data
- ☐ test setup, pre-test data, test data, and report data

Data files are created or selected at the beginning of each test. Template or setup data is entered or copied into the data file before the test is run. This information may be saved and the file re-opened at a later time to run the pre-test or the test. Test result data is entered into these files when the pre-test and the test is running. Report data is entered into the data files at the completion of the test. Completed test files may be opened at any time to review or print test results.

Data Records

The number of data records acquired by the HFTS System. Records are numbered sequentially beginning with one at the start of each test. The number of completed data records may be displayed in the status bar on the bottom of the screen. Data records contain the following information:

For Quasi-stationary or Fluctuating harmonics

- ☐ Each Rectangular-window record contains data from 16 cycles of the fundamental frequency at 50 and 60 Hz. 40 current harmonic values, rms current, rms voltage, and real power is calculated for each data record.
- ☐ Each Hanning-window record contains data from 24 cycles of the fundamental frequency at 50 Hz, and data from 32 cycles of the fundamental frequency at 60 Hz. 40 current harmonic values, rms current, rms voltage, and real power is calculated for each data record.

For Voltage Fluctuations

- ☐ Each Rms/Instantaneous Flicker record contains rms data and instantaneous flicker data acquired at a rate of one record per second. 100 data points at 50 Hz (120 data points at 60 Hz), integrated over a 1/2 cycle period, are returned for rms voltage. 100 data points at 50 Hz (120 data points at 60 Hz), sampled once every 10 ms at 50 Hz (once every 8.33 ms at 60 Hz), are returned for instantaneous flicker.
- ☐ Each Pst data record contains "time-at-level" occurrences for instantaneous flicker data acquired during the specified integration period (1, 5, 10, or 15 minutes). The data is accumulated into 1024 logarithmically scaled bins, which are log-weighted by flicker level in the range of 0.01 to 10,000 perceptibility units. Based on this data, Pst values are calculated for each integration period.

Errors

Glossary

These are the instrument-specific error numbers that are returned by the HFTS System. Errors are displayed in the status bar on the bottom of the screen. Errors can also be displayed on the front panel of the unit by pressing the **Shift** and the **Error** key. Typical errors include errors such as current limit or saturation of the current measurement circuits when operating a high power load in the low current range.

Failures

Failures are those conditions that will cause a test to fail the IEC standards. The number of failures are displayed in the status bar on the bottom of the screen. You can override the failure criteria by specifying an override percent in the Test Setup Advanced Options window. Test limits may be adjusted above or below the values specified by the standard, but any adjustment above 100% will flag the test as invalid in the test report.

Fluctuating Harmonics

Harmonic currents that vary significantly over time. A power supply may generate fluctuating harmonics if the load on its output changes over time.

Flicker

Flicker, or voltage fluctuations, is the familiar phenomenon of incandescent lights decreasing or increasing in intensity when another appliance such as a hot plate turns on and off. Flicker can be random, or it can be a regular modulation of lamp intensity.

Integration Period

The integration period specifies the time during which instantaneous flicker values are accumulated for subsequent evaluation as short term flicker or Pst. The integration period is determined by the selected Pst integration time. The Pst integration time can be specified as 1, 5, 10, or 15 minutes. The **resulting time** (total test time) equals the number of integration periods multiplied by the Pst integration time. For example if the Pst integration time is specified as 10 minutes, and 12 integration periods have been selected, the total time of the test will be 2 hours.

Template Files

Template files contain test-setup data. Template information is included with the test data when the test is run. At the beginning of each test you can elect to use an existing template file when running your test, or you can create a new template for the test by entering new setup information in the Main and Test Setup screens.

Percent of Threshold

Specifies a threshold as a percent of the IEC standards. For example, if the IEC standard specifies that any measurement of a third harmonic current above 2.3 amperes is a failure, a 90% threshold may be used to specify that values greater than 2.07 amperes may generate a watch event.

Quasi-stationary Harmonics

Harmonic currents that are steady-state. A switch-mode power supply with constant loading typically generates this type of harmonic.

Watch Events

Watch events are test parameters that you can specify to trigger the termination of the test. Watch events may or may not result in failures. For example, when testing Quasi-stationary Harmonics, you may configure the test to terminate when a specific harmonic approaches 95% of the standard. In this way you can examine the test results that existed at the time the test terminated.

C

IEC Commands

Introduction

The 4801iL is designed to operate in Normal as well as IEC mode. In normal mode, the Harmonic/Flicker Test System responds to all of the commands that program ac source operation. In IEC mode, the Harmonic/Flicker Test System provides full IEC 1000-3-2 and IEC 1000-3-3 compliance test capability. The System Mode command details the differences between Normal and IEC mode.

When the HFTS System is being used in IEC mode, the Harmonic/Flicker Test (HFTS) software handles all of the communication between the user and the HFTS System. The HFTS Software must be loaded and running in Microsoft Windows on a personal computer that is connected to the HFTS System.

The IEC commands are described in the iL Series AC Source/Analyzer SCPI programming manual (CI P/N 5001-969) These commands are provided for those users who need to directly program the IEC functions of the HFTS System without using the HFTS Software. Be aware that these commands will return "raw" IEC measurement data from the HFTS system. It is the programmer's responsibility to interpret the data according to the IEC standards.

D

Error Messages

Error messages may occur when you are using the HFTS software. These error messages are accompanied by an explanation that describes what has occurred, and in some cases the appropriate action to take.

Error messages that are related to the 4801iL IEC Test System hardware operation may require you to refer to the SCPI Programming Guide or the User's Guide for additional information.

A

about 11, 22, 24, 56

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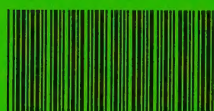
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